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WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

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GAS PURIFICATION
BY
OXIDE OF IRON.

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Does not Blister, Crack, or Flake off.
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TELESCOPIC & SINGLE GASHOLDERS,
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Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
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From ½ to 40 H.P. ind.
See Advertisement in last week's JOURNAL, page 638.

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Now ready, GAS CHANDELIER BOOK (Reduced Prices), 7s. 6d.

C. & W. WALKERS'
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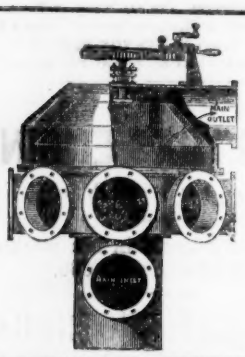
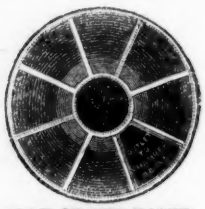
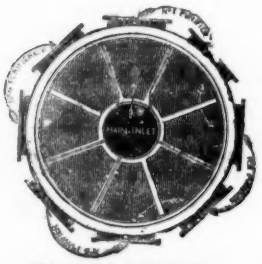


ELEVATION OF THE CENTRE-VALVE.



PLAN OF THE VALVE.



PLAN OF THE BODY.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

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PARIS EXHIBITION, 1878.

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AND

HONOURABLE MENTION

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For their Various Exhibits, amongst which is a

SILVER MEDAL

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Being the Highest Honour given for this class.

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IMPROVED DRY GAS-METERS;

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GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS.

And all kinds of Experimental Gas Apparatus.

WARNER'S RETORT-HOUSE MACHINERY.

[*As Illustrated and Described in the* JOURNAL *for May* 4.]

Communications to be addressed to

W. J. WARNER, GAS-WORKS, SOUTH SHIELDS.

NO MORE WASTE LIME! SAVE THE VALUABLE PRODUCT!

G. R. HISLOP'S PATENT REGENERATIVE PROCESS

Most Effectively and Economically restores this waste *ad infinitum*.

The Patentee having devoted more time and attention to this subject than perhaps any other person living, is now in a position to recommend the adoption of this process to Gas Companies and Corporations with the utmost confidence in its practical utility, convenience, and economy. 1st. It restores the spent Lime at from one-third to one-half its original cost, apart from its undoubted convenience and the economy of space. 2nd. There is practically no limit to the duration of the Lime. 3rd. The cost of apparatus for the introduction of the process is very moderate and exceedingly durable. 4. The Patentee supplies special bricks and castings, erects and proves the process on the most favourable terms.

The process, in operation, may be seen at the Corporation Gas-Works, Paisley, where the Lime has been restored 120 times. Inspection is cordially invited.

For Terms, apply to GEO. R. HISLOP, F.C.S., Engineer, Gas-Works, PAISLEY, N.B.

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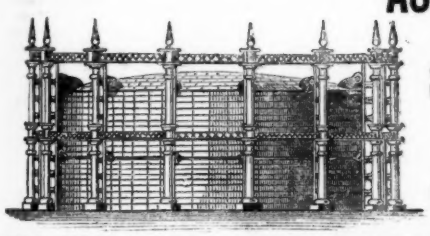

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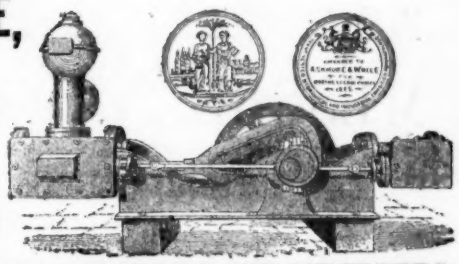
STOCKTON-ON-TEES,

ENGINEERS

AND MAKERS OF

GASHOLDERS

AND



GAS APPARATUS, ROOFS, BRIDGES AND GIRDERS, BOILERS, PURIFIERS AND SCRUBBERS,

Also of the "SLIDE-VALVE" STEAM-PUMP,

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No possibility of Valves sticking, as they are actuated by positive motion from an eccentric.

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NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

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They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

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An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS. MEDIÆVAL FITTINGS for CHURCHES, &c.

PATTERN-BOOKS and PRICE LISTS furnished.

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GAS PURIFICATION & CHEMICAL Co., LIMITED,
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D'USINES À GAZ ET CONDUITES D'EAUX.

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The Comptoir Général of Gas and Water Works is authorized by a leading Company to **Buy Gas and Water Works and Concessions.**

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M. L. MOSER DULFUS, the Proprietor of the **Comptoir Général,** has had Twenty years experience in financial affairs, and has a large and influential connection in England, France, and on the Continent.

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PURIFIERS, CONDENSERS, SCRUBBERS, GASHOLDERS, ROOFS,

And every description of Gas Machinery.

TENDERS GIVEN FOR WORK FIXED COMPLETE IN ANY PART OF THE KINGDOM.

WEST'S GAS IMPROVEMENT COMPANY.
LIMITED,

ARE NOW PREPARED TO SUPPLY AND ERECT THEIR PATENTED MACHINERY FOR

CHARGING AND DRAWING GAS-RETORTS,

And to enter into arrangements with GAS COMPANIES for its use upon moderate terms of Royalty.

The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*

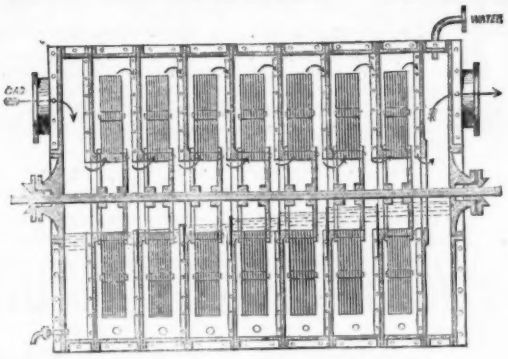
The advantages attending its use are—

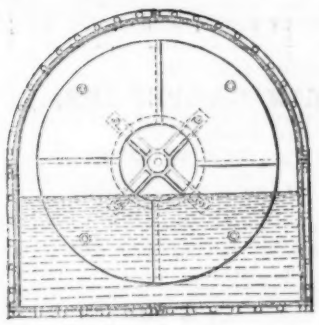
INCREASED VOLUME OF GAS PER TON.—INCREASED YIELD PER RETORT.—INCREASED BULK OF COKE FOR SALE.—REDUCTION IN LABOUR AND LESS DEPENDENCE ON SKILLED STOKERS.

A Pamphlet containing a description of the Machinery, and Copies of Reports on the working of the same, &c., will be forwarded on application to the MANAGING DIRECTOR, Maidstone. Communications may also be addressed to the Consulting Engineer, R. P. SPICE, Esq., M. Inst. C.E., 21, Parliament Street, London, S.W., or to the Engineer and Analyst, F. W. HARTLEY, Esq., A. Inst. C.E., 55, Millbank Street, London, S.W.

KIRKHAM, HULETT, & CHANDLER, LIMITED.

PATENT "STANDARD" WASHER-SCRUBBER COMPANY.





These Machines contain from 3200 feet to 65,000 feet of Wetted Surface.

The Special Merits of this Washer are as follows:—That it is not necessary to reduce the temperature of the gas to 60°, or thereabouts, to make it effective; **and that as no tar is retained in it, the illuminating power is not reduced as in Tower Scrubbers.** That the distribution of the liquor is made with unerring regularity. That it occupies very small space, so that it can be, at little expense, effectually protected from extreme changes of the weather. That the considerable expense of Coke or Wood, or other Scrubbing Material, is entirely saved, and that the great nuisance and cost of from time to time replacing the Scrubbing Material is avoided. That, by the revolution of the discs, the quantity of water carried up by them, and tending continuously to fall, exposes a very large amount of fresh wetted surface to contact with the gas as it ascends. That it is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured. That it is much cheaper than any other Scrubber that will do the same amount of work effectually. That it is the only Washer suitable for purifying Gas from all its impurities by solution. That it works with a minimum of pressure. That it takes out every trace of Ammonia from the Gas in once traversing the machine, as well as a very large quantity of carbonic acid and sulphuretted hydrogen. That it requires very little outlay for foundations.

The following Testimonials show the opinion of eminent Engineers as to the capabilities of the Washer:—

Messrs. KIRKHAM and HERSEY. *The Gaslight and Coke Company, Beckton, North Woolwich, June* 8, 1880.

Gentlemen,—I enclose you some particulars of the working of your Washers here, and I intend having some more experiments made, as just now we are working the first Washer with liquor and the second with water. Of course the fact of our having ordered two more, in addition to the four which we have in use, is a sufficient indication of my opinion of the value of the Washer.

(Signed) G. C. TREWBY.

Messrs. KIRKHAM AND HERSEY. *South Metropolitan (late Phœnix) Gaslight Company, Engineer's Office, June* 19, 1880.

Dear Sirs,—The "Standard" Washer which you supplied for use at our Vauxhall station has afforded me entire satisfaction. It was designed to remove the ammonia from 3 million cubic feet of gas per day, and during the past winter it did so with a good working margin to spare. It is as excellent now in workmanship as in design, and is well worthy of the general acceptance with which it appears to be meeting.

I am, faithfully yours, (Signed) CORBET WOODALL.

Messrs. KIRKHAM, HULETT, and CHANDLER. *The Gaslight and Coke Company, York Road, King's Cross, Jan.* 14, 1879.

Gentlemen,—In reply to your inquiry, I am pleased to say the Washer which was put in action at this station in October last has quite fulfilled my expectations, as it confirms the experiments I made in May last with the smaller machine. Working at four revolutions per minute, **it takes out every particle of Ammonia,** while purifying more Gas than it was intended to do. I enclose particulars of a week's working during our heaviest make, by which you will see that it yields the full quantity and strength of liquor, and works with little pressure. I am therefore quite satisfied with the machine, and trust it may meet with the success it deserves.—I remain, &c., (Signed) JOHN CLARK, Engineer.

Messrs. KIRKHAM, HULETT, and CHANDLER. *Corporation of Birmingham, Gas Department, Saltley Works, May* 23, 1879.

Gentlemen,—I beg to enclose you a copy of the results of the tests which, by the kind permission of the Engineer, Mr. Clark, I made on the 6th of March last, of the working of one of your "Standard" Washers and Scrubbers at the St. Pancras Station of The Gaslight and Coke Company, and I am of opinion that, for an apparatus occupying so small a space, they are exceedingly satisfactory.—Yours truly, HENRY HACK, Engineer.

Messrs. KIRKHAM and HERSEY. *The Leeds Corporation Gas-Works, Meadow Lane, Aug.* 14, 1879.

Gentlemen,—In reply to your inquiry of yesterday's date, I have pleasure in stating that the item appearing as income derivable from Ammonia in my estimate of revenue for current year is not an exaggeration. Our average income from Ammonia is 2s. 8d. per ton of coals carbonized, but at the works where your invention is in use we derive not less than 3s. per ton. Since the introduction of efficient Scrubbers at our works the greater yield of this product (now twice as valuable as coke to us) is such that the cost of Apparatus for its extraction can be wholly paid for out of from nine to twelve months gains. I am, Gentlemen, yours faithfully, (Signed) H. WOODALL, Engineer.

Messrs. KIRKHAM and HERSEY. *Heywood Local Board Gas-Works, Hooley Bridge, Heywood, Dec.* 1, 1879.

Gentlemen,—In reply to your favour of the 28th ult., I beg to state that the Scrubber is at work, and doing well. I shall be glad to show it to any inquirers.—Yours truly, (Signed) EDWIN BUCKLEY, Engineer.

Dukinfield, Denton, and Haughton Gas-Works, Dukinfield, July 31, 1880.

Messrs. KIRKHAM, HULETT, and CHANDLER, LIMITED, 59, Palace Chambers, Westminster.

Gentlemen,—We commenced the use of your "Standard" Scrubber on the 1st of February last, and from that date to the end of June we had passed 168⅔ tons of Ammoniacal Liquor of 6° strength into the tar well, as indicated by a liquid-meter. This liquor being sold at 19s. per ton realized £160, which was a clear gain to us of 1s. 0½d. per ton of Coal carbonized, due to the use of your Washer, in addition to which there was a saving in the cost of purification.

During the above period we had removed the Ammonia from 28¼ million feet of gas, and as we make 81 millions yearly, the saving, at the same rate, would be £460 per annum. The Apparatus (without foundations and connections) cost £420, so that it will pay for itself within twelve months of its erection. I am, yours truly, (Signed) HARRISON VEEVERS, Engineer and Manager.

Messrs. KIRKHAM, HULETT, and CHANDLER, LIMITED. *Leominster Gas and Coke Company, Limited, March* 20, 1880.

Gentlemen,—In reply to yours of the 18th inst., we have a 3½-horse power "Otto" Silent Gas Engine; this drives by belt a 5000 feet per hour Beale's Exhauster, Tar, Liquor, and Water Pumps, and your "Standard" Washer-Scrubber. The engine is easily managed, and is sufficient for nearly double the work it has yet had to do. I think 1 to 1½-horse power engine amply sufficient for a Washer 7000 to 10,000 feet per hour.

With regard to your Washer-Scrubber, it causes a very decided improvement in the illuminating power of the gas—say 1½ candle; it is now 17 candles by No. 1 Sugg's Argand burner. Clear water supplied at the rate of 10 gallons per ton of coal comes out 5° to 6° Twaddel, and we find the purifiers much freer from tar, and requiring less lime.

Our Working Manager says your Washer is the best machine that ever came into the works.

Yours truly,
(Signed) JOHN F. SOUTHALL.

For further particulars and testimonials, address Messrs.

KIRKHAM, HULETT, & CHANDLER, LIMITED, { 59 & 60, Palace Chambers, Bridge St. Westminster, London, S.W.

C. & W. WALKER'S
WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

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ESTABLISHED IN 1860.

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THE ORIGINAL MANUFACTURER OF THE IMPROVED
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Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.
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BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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Manufacture and keep in stock at their works (also a large stock in London) PIPES and CONNECTIONS 1½ to 48 inches in diameter; and make to order Retorts, Purifiers, and Tanks, with or without planed joints, Columns, Girders, Special Castings, required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Syphons and Covers are joint-faced if required, doing away with millboard and iron boring, or Syphons made without Covers, a socket being cast on and fitted with a small plug about 6 inches in diameter with lead joint. In either way preventing leakage.

GEORGE'S
Patent Gas Calorigen,
A STOVE FOR
WARMING AND VENTILATING.
RECOMMENDED BY DR. RICHARDSON.

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Supply and Erect Street Lamp Columns, together with Head Irons and Lanterns, as well as all the other fittings connected therewith.

S. P. & Co. also contract with Gas, Railway, and other Companies, Local Boards, and Vestries, for the maintenance and repair of Lamps and Fittings.

Gold Medal Awarded, Paris Exhibition, 1878.

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SHEAF AND SPRING WORKS,
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MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS,
STEEL OF ALL DESCRIPTIONS,
SCREW STOCKS, TAPS, AND DIES, SPANNERS,
RATCHET BRACES, LIFTING-JACKS,
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AND ENGINEERS TOOLS GENERALLY.
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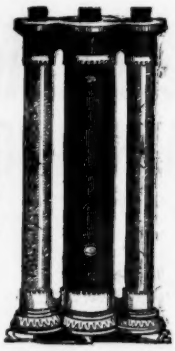
3 feet 6 inches.

RITCHIE'S
GAS OR OIL
HEATING AND LIGHTING
STOVES.

Silver Medal awarded in 1878, at Wolverhampton Exhibition.

No Injury to Pictures or Plants.
No Flue.
No Danger from Fire.
No Offensive Smell.
Light and Warmth combined.
Cost less than other Fuel.

MESSRS. RITCHIE & Co. are prepared to supply these Stoves on the best possible terms to Gas Companies to let out to their Consumers on the hire system.

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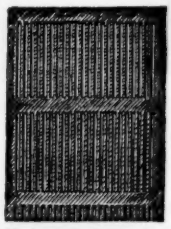
3 feet 6 inches, 5 feet, and 6 feet.

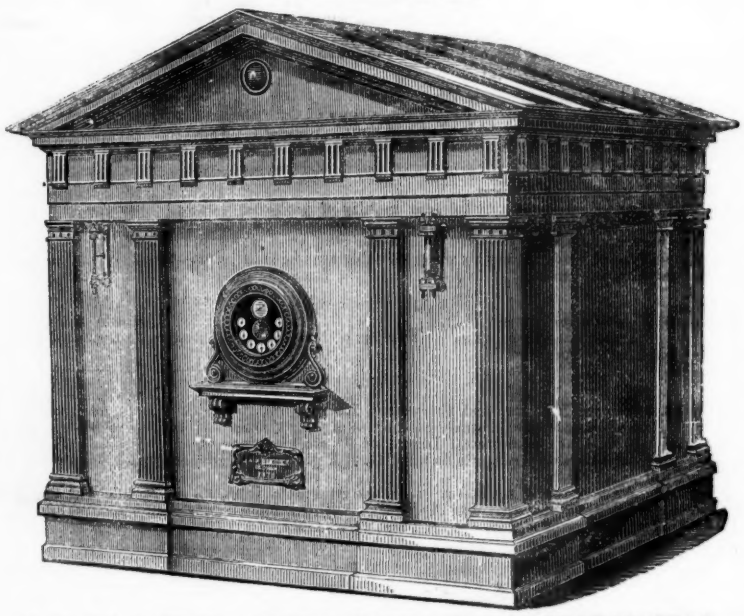
For Heating only. For Light & Heat.

R. DEMPSTER AND SON'S
WOOD SIEVES FOR PURIFIERS,



WITH TAPER OR PARALLEL BARS,
MADE BY SPECIAL MACHINERY.
SCRUBBERS FILLED WITH BOARDS,
On our approved principle, for the extraction of Ammonia.
Prices on application. References to First-Class Engineers.
ROSE MOUNT IRON-WORKS,
ELLAND, NEAR HALIFAX.
LONDON OFFICES: 2, SUFFOLK LANE, CANNON STREET, E.C.

J. & J. BRADDOCK,
GLOBE METER-WORKS, OLDHAM,
MANUFACTURERS OF
WET & DRY CONSUMERS GAS-METERS,
OF THE HIGHEST EXCELLENCE ONLY;
BRADDOCK'S PATENT COMPENSATING GAS-GOVERNORS;
ALSO LICENSEES AND MANUFACTURERS OF
WARNER & COWAN'S PATENT SELF-REGULATING GAS-METERS;
ROUND STATION-METERS,
ON CAST-IRON STANDS.



SQUARE STATION-METERS,
WITH PLANED JOINTS.
GOVERNORS, GAUGES, INDICATORS, MAIN COCKS, &c.
GAS COOKING APPARATUS.
Home and Foreign Orders promptly attended to.
All Sizes of CONSUMERS METERS, STATION-METERS, and GOVERNORS generally in Stock.
Orders almost invariably despatched on the day of receipt.
TERMS, &c., ON APPLICATION.

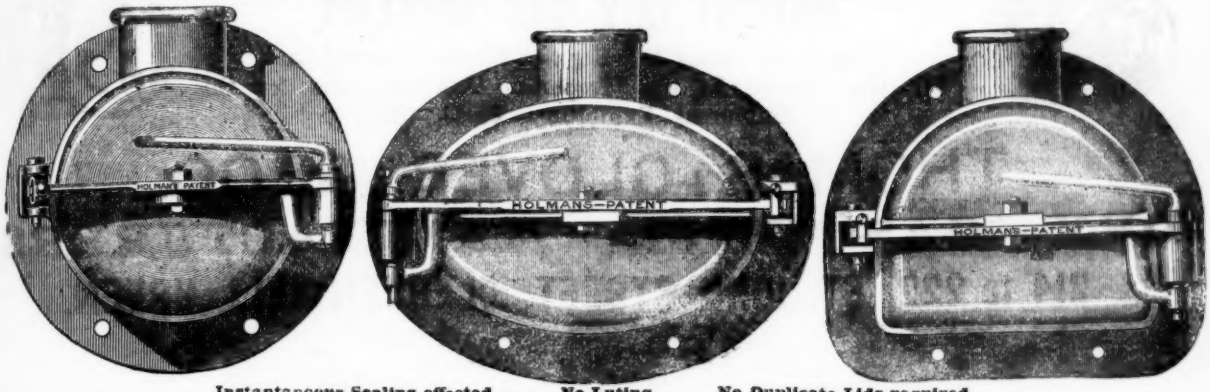
TANGYE BROTHERS AND HOLMAN,

CORNWALL HOUSE, QUEEN VICTORIA STREET, LONDON, E.C.

SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and Self-Sustaining Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.

Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Morton's Patent Retort-Lids are in use in nearly all the Principal Gas-Works in the United Kingdom and the Colonies; also on the Continent and in the United States of America. They are now made of the

SAME FORM OR SECTION AS THE RETORT. (See Illustrations above.)

Engineers preparing Specifications of New Works will be furnished with Dimensions of Stock Patterns, together with Approximate Weight and other data on application.

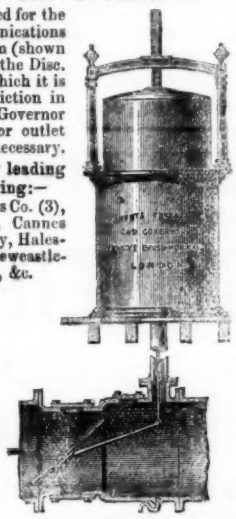
HUNT'S

EQUILIBRIUM DIRECT-MAIN GAS GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor **is extremely sensitive to alterations of inlet or outlet pressure,** and renders a large actuating holder unnecessary.

These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight & Coke Co. (19), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Leicester, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.



TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

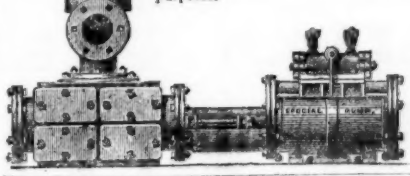
Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,
(Signed) JOHN JOHNSON.

THE

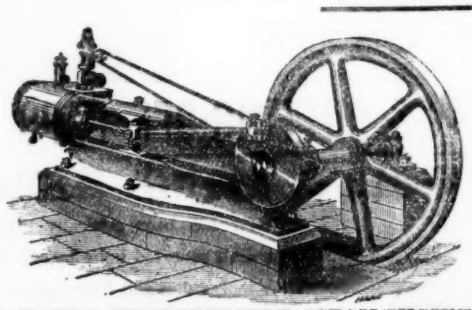
"SPECIAL" DIRECT-ACTING STEAM-PUMP.

These Pumps are in use in upwards of one hundred Gas-Works in the United Kingdom, &c., pumping Water, Tar, Ammoniacal Liquor, &c. For Tar, &c., they are provided with extra long distance pieces, and Pumps are entirely of iron, with faced valves to withstand the action of the liquid. The sizes below marked thus * are usually kept in stock for these purposes.



The quantities delivered of Tar should be taken about two-thirds that of water.

Diameter of Steam Cylndr.	Diameter of Water Cylndr.	Length of Stroke.	Gals. of Water per Hour, Approx.	Prices for Water.	Prices for Tar and Ammoniacal Liqr.
*3 in.	1½ in.	9 in.	450	£16 0 0	£17 0 0
*4 ,,	2 ,,	9 ,,	815	18 0 0	19 0 0
*5 ,,	2¾ ,,	12 ,,	1,250	21 0 0	23 10 0
*5 ,,	3 ,,	12 ,,	1,830	22 10 0	24 0 0
*6 ,,	3 ,,	12 ,,	1,800	25 0 0	26 10 0
*6 ,,	4 ,,	12 ,,	3,250	30 0 0	31 10 0
6 ,,	5 ,,	12 ,,	5,000	35 0 0	36 10 0
*7 ,,	5 ,,	12 ,,	5,070	40 0 0	41 10 0
7 ,,	6 ,,	12 ,,	7,350	45 0 0	46 10 0
*8 ,,	6 ,,	12 ,,	7,350	50 0 0	52 0 0
10 ,,	6 ,,	12 ,,	7,350	60 0 0	62 10 0
10 ,,	8 ,,	12 ,,	13,080	75 0 0	77 10 0



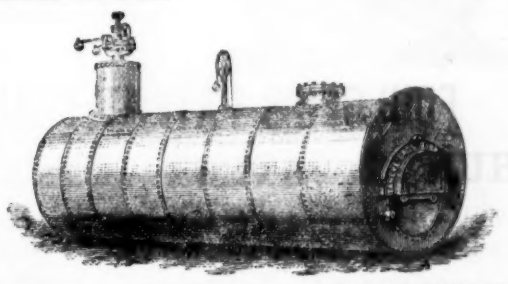
TANGYE'S HIGH-PRESSURE STEAM-ENGINE,

NEARLY 4000 IN USE.

The Design, Workmanship, and low prices of these Engines have called forth universal approval.

Nom. H.P.	2	3	4	6	8	10	12	14	20	25
	£28	£37	£44	£68	£86	£111	£122	£133	£185	£215

Including Governor and Feed Pump. Variable Expansion extra.



CORNISH, LANCASHIRE, "THE KESTERTON," VERTICAL, AND MULTITUBULAR STEAM-BOILERS OF SUPERIOR QUALITY ALWAYS IN STOCK.

This Department having been greatly extended and furnished with the most approved Boiler-making Machinery and Tools, T. B. & H. are prepared to supply all kinds of Steam-Boilers with great facility at lowest current prices.

Also Makers of IMPROVED HYDRAULIC HOISTS, TRAVELLERS, CRABS, CRANES, PULLEY BLOCKS, HYDRAULIC AND SCREW LIFTING JACKS, LATHES, PUNCHING AND SHEARING MACHINES,
And all other Descriptions of Tools, &c.

FULL PARTICULARS, ESTIMATES, CATALOGUES, &c., ON APPLICATION.

London, 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

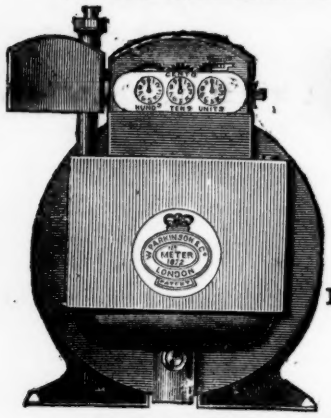
LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS.

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON AND CO.

(ESTABLISHED 1816)



WET & DRY METERS,

STATION-METERS & GOVERNORS,

EXHAUSTER REGULATORS,

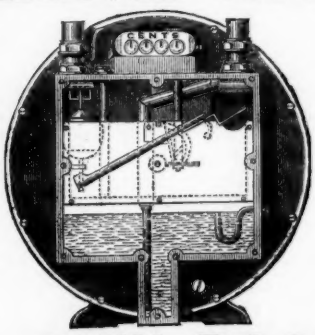
PRESSURE REGISTERS, EXPERIMENTAL APPARATUS, GAUGES, WATER-METERS, &c.

SOLE AGENTS FOR

FOULGER'S PATENT SEAL UNIONS & CUTTING-OFF CAPS.

HUNT'S PATENT IMPROVED COMPENSATING METER.

In this Meter, the action of the measuring-drum is reversed. By this arrangement an improvement is effected in the registration at high speeds, which, in many tests, has not varied from the smallest light to three times the capacity of the meter. It works equally well under all pressures. The range of error between the high and low line is much smaller than that allowed by the "Sale of Gas Act."



The Meter has been critically tested, and most favourably reported upon by official Meter Inspectors in London and Birmingham.

W. PARKINSON and CO. have made arrangements for the manufacture of these Meters, both in tin and cast-iron cases, and for the alteration of old ones to this principle, which is confidently recommended as possessing every quality that can be desired by Gas Companies, Corporations, or Private Consumers.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

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TO CORRESPONDENTS.

H. N. H.—*Next week; too late for to-day.*

A Permanent Subscriber (Vienna).—*See last week's issue; also again to-day. Thanks, however, for the hint.*

W. K.—*The question will possibly soon come forward in a more important form. We will not forget your remarks at the proper time.*

Received.—"*Stationary Engine Driving: A Practical Manual for Engineers in charge of Stationary Engines.*" *By Michael Reynolds, M.S.E. London, Crosby Lockwood and Co.;* 1881.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, NOVEMBER 2, 1880.

Circular to Gas Companies.

The speeches of the President of the Board of Trade at Birmingham last week, in connection with the inauguration of the Chamberlain Memorial, have naturally given rise to some comment in the daily press. The utterances of a Cabinet Minister necessarily attract attention at all times, in general as much, perhaps, from the official position of the speaker, as from any personal eminence he may otherwise possess. Sometimes, however, a Minister of the Crown may be found to possess claims to public notice not only because of his personal and official standing, but also from the fact of his being the representative of some particular class; and this is peculiarly the case of the Right Hon. Joseph Chamberlain. In fact, Mr. Chamberlain may be said to represent at least two separate sections of public men—the one on account of his well-known political complexion; and the other, with which we are more concerned, in consequence of his being the most notable example of the truth that Imperial distinction may, in the present day, follow upon thorough work in the apparently restricted field of local government.

Mr. J. Chamberlain's career in connection with the administration of the affairs of Birmingham attracted much general interest from the first development of his particular method of handling municipal matters, and the importance naturally belonging to the great Midland town was to some considerable extent enhanced, in the estimation of those interested in watching the growth and consolidation of our youthful scheme of local self-government, by the prevailing impression that an administrator, if not exactly "heaven-sent," at least of uncommon force of character, was devoting himself to local affairs with the ardour commonly associated with more pretentious political objects. To any one accustomed to mark the ceaseless squabbles and unfruitful rivalries which occupy the time and waste the energies of many representative bodies, the practical dictatorship popularly supposed to have been exercised in Birmingham by Mr. Joseph Chamberlain, up to his voluntary withdrawal from active work in the Corporation, must have appeared no mean testimony to the completeness with which he succeeded in identifying himself with the opinions and desires of his colleagues, or in bringing theirs up to the level of his own. If his success had lain in the former procedure, it would have been impossible for him to have carried out the many projects which are locally identified with his name, and in the execution of which his own individuality became so invariably conspicuous. Hence we are led to believe that he possesses as much creative ingenuity as administrative ability, and that his fellow-townsmen really followed his lead.

That the lever with which Mr. Chamberlain worked in the Birmingham Town Council was the practically handy though theoretically cumbrous one of party politics, is not of much real moment, except as supplying one of the reasons why he should have been sought out for that reward of high office to which the same influences open the way. But in the councils of the nation, as in his accustomed local sphere, it is not to be supposed that the energetic reformer will regard politics as anything more than the means to achieve definite ends. The ability to lead the opinion of his colleagues will serve the Cabinet Minister in as good stead as it served the Mayor and Alderman, and the mental bias which impelled the latter to strike out new lines of progress, in the conduct of the business which lay nearest to his hand, will not desert him in consequence of his brilliant transformation. What will these lines now be? It is not to be expected that in the Imperial Cabinet any one man can, at will, so control the course of events as to invest the annals of an Administration with the character of a record of the work of his own department. It was a very sore point indeed with the present holders of office, during the time when the late Government were in power, that domestic legislation was shunted in favour of foreign policy. It may be a disappointment to the President of the Board of Trade to experience the necessity of remaining somewhat in the background, as far as his own office is concerned, while he has to advise with his more occupied brother Ministers on questions of overawing Turks or curbing Mr. Parnell. It is possible, though it is not very probable, that the occasion may not present itself, during Mr. Chamberlain's tenure of office, for him to startle or gratify the public by the inauguration of any new departure in those branches of his departmental occupation wherein his province marches with the domain of the Local Government Board. But if he does find work suited to his mind, in conjunction with one or more of his colleagues, in re-arranging say the organization of the Metropolis, or enlarging and amending the powers possessed by local authorities, we know to what his whole past training has tended to lead him, and in his latest utterances we yet find him asserting that the acquisition by public authorities of gas and water undertakings still possesses with him an importance even exceeding some of the recent incidents of Imperial foreign policy.

We need not discuss the precise state of Mr. Chamberlain's convictions with respect to the latter description of his official responsibilities; it is enough for us to note that the President of the Board of Trade is now, as ever, an expressed enemy to Gas and Water Companies, as such, although he decidedly likes their property. If he could have his own way in the matter, he would probably provide every possible facility for the "happy despatch" of all Companies trading in the two necessities of town life; but his opportunities in this direction may fall short of his aspirations. Meanwhile, it is as well to know what is the bent of the official mind, and this Mr. Chamberlain very frankly opens to us. It is, however, unfortunate that the practice of the Birmingham Gas Department does not hold out much hope that the present Chief of the Board of Trade will in all cases resolutely defend the rights of gas consumers, by setting his face against Corporations dealing in gas at a profit. The Birmingham practice in this respect is the great blot on the otherwise admirable management of the gas undertaking, and is not the least operative cause of those costly arbitrations and severances of districts formerly supplied by the Staffordshire

Company, in which Mr. Chamberlain's name is not held in such high veneration as it appears to be within the limits of the borough. For ourselves, we confess that our admiration of the works of improvement carried out by the Town Council during the last few years would be infinitely greater, and our estimate of the public spirit of the authorities and public of Birmingham would be much higher, could we be assured that they were the spontaneous outcome of a far-seeing policy, instead of being in a great measure supported by the involuntary contributions of a portion only of the population. And we trust that in any proposals which may emanate from Mr. Chamberlain for dealing with Gas and Water Companies in the way which most pleases him, he may look less at possible "plunder" attending their management, and more at the principles of equitable taxation to which he and his school of politicians are such staunch adherents.

Judgment was given, on the 27th ult., by Mr. W. H. Higgin, Q.C., Chairman of the Salford Hundred Court of Quarter Sessions, in the matter of the petition by two gas consumers for a reduction in the price of the gas supplied by the Stretford Gas Company. The case has been already referred to in the JOURNAL, and it need only be repeated that the action was taken under certain provisions of the Gas-Works Clauses Act, 1847, which authorize Magistrates, sitting in Quarter Sessions, to appoint, upon the petition of two gas ratepayers, an Accountant to examine a Gas Company's books, and if the profits made by the Company have exceeded the prescribed limits, to order a fair reduction to be made in the price of gas. In the present case the Court found for the petitioners, there being practically no defence as to the division of excessive profits, the officers of the Company and of the Court differing merely as to the amount that had been so divided, which, of course, did not affect the main principle involved. A strong point was, however, raised on behalf of the Company, that as the phraseology of section 35 of the Act presupposes the formation of a reserve-fund with the excess profits, and the directions to the Court as to procedure in cases of this kind apply specifically to such a fund, the fact that the Company had neglected to comply with section 31, and had failed to establish any reserve-fund at all, must be held to have placed them beyond the jurisdiction of the Court. This contention was disposed of by the Chairman in delivering judgment, though not without acknowledgment of its plausibility, by making the bold assumption that as the Company had had enough money at one time to constitute such a fund, they must therefore be held to have done so, in spite of the evidence to the effect that they had otherwise disposed of the money. That is to say, that any surplus moneys in hand necessarily partake of the nature of a reserve-fund, although not actually set aside or invested under this title. Hence it was ordered that the price of the Company's gas should be reduced to 3s. 2d. from 3s. 6d. per thousand cubic feet. The Court made an order for payment by the Company of the costs of the petitioners, and held out every inducement to them to appeal from the decision, with the view, openly expressed by the Chairman, not only of strengthening the reading by the Court of their powers of jurisdiction under the Act, but also of testing the power of the Superior Court of ordering the Company to refund the wrongfully divided profits. This course the Company did not appear willing to take, and consequently, although it would be of general interest to have the loose wording of the Act thoroughly gone into, in connection with a case which forms a precedent of such importance, this disagreeable matter will probably end where it is, with advantage to the parties immediately concerned.

Referring to our comments in last week's JOURNAL on the British Gaslight Company's latest difficulty with the Norwich Town Council, we find it will, perhaps, be advisable to correct a false impression which may easily be formed from the concluding sentences of our remarks respecting the practical issue of the debate in the Council. The report of the Special Committee on the relations of the Corporation with the Company states, with respect to the power of auditing the Company's accounts possessed by the Corporation, that "no "appointment or re-appointment [to the office of Auditor] "has been made since 1858." If this is not calculated to convey the impression that no audit has been made during the period, we do not know the meaning of the English language. As a matter of fact, however, it now appears that Mr. R. J. Richardson was appointed by the Corporation in 1858 to audit the accounts of the British Gaslight Company in connection with their Norwich station, and he continued to discharge his duties in that office until the early part of the present year. Every statement of accounts furnished by the Company to the Corporation for twenty years was signed by this gentleman, and no complaints were made as to their accuracy until recently, after he had ceased to occupy that position. Now a fresh appointment is to be made, and it is difficult to see that such a tremendous indictment was necessary to sustain such a very simple proceeding. It is quite preposterous to imagine that the Company will be in the least affected by the appointment of any Auditor; but it is not so certain that the reports of a professional Accountant, dealing with facts instead of suppositions, will bear out the statements of the local financial geniuses, and in that case the unfortunate official will probably come in for his share of the misrepresentation and abuse which have been of late so freely indulged in respecting the Company.

A letter by Mr. W. H. Preece, in *The Times* of the 28th ult., on the subject of electricity in collieries, comes very opportunely after our remarks in last week's JOURNAL on the danger of the present forms of electric lamps. Mr. Preece is President of the Society of Telegraphic Engineers, and can, therefore, scarcely be considered as prejudiced against the extended use of electricity, yet we find him stating that "it cannot be too "strongly insisted that the absolute safety of the electric "light is a popular delusion." In the communication in question Mr. Preece chiefly addresses himself to refute the arguments of certain persons, whose enthusiasm is equal only to their ignorance, and who have lately been distressingly persistent in advocating the use of the electric light in collieries. Upon these enthusiasts Mr. Preece throws enough cold water to extinguish utterly their feeble and uncertain glimmer of suggestion. His exposure of the risks incurred in the use of electric lamps is rather startling, yet justifiably so, in the light afforded by recent experience. He points out the danger of igniting the gas in mines by the intense heat of the electric arc, and also the liability to loss of life and to fire by imperfections in the coating of the conducting wires. According to this authority, the difficulty of keeping ordinary telegraphic currents in their proper courses is very great, and any faults in the insulation of the wires cause loss of electricity to earth, attended with heat, and occasionally fire. He states that ordinary telegraphic offices have, to his knowledge, been set on fire in this way, in New York and Boston, and expresses his belief that the recent fire at the Manchester Telegraph Office may have arisen from such a cause. If this be so, how much greater must be the danger of fire from currents many thousand times more powerful than any used in telegraphy, such as are those necessary for the development of the electric light? Mr. Preece's letter is eminently calculated to disturb the equanimity of the custodians of the library of the British Museum, who have lately adopted the Siemens light, after having consistently denied admission to gas as being too dangerous. It is to be hoped that they will not have cause to regret their action, for the reason declared by Mr. Preece to exist in such force as to entirely preclude the use of any known form of electric light in mines where inflammable gas is found.

The Gas Department of the Birmingham Corporation has issued a carefully compiled illustrated catalogue of apparatus for the use of gas for cooking, heating, and trade purposes. The illustrations given are from designs furnished by manufacturers of the different articles, whose fixed prices are in all cases stated, as the department does not manufacture any of the goods, but undertakes their supply and fitting up if required, and keeps a show-room where they may be inspected by consumers, and any information respecting cost and manner of using them obtained. The department does not attempt to do a pushing trade to the detriment of the wholesale or retail traders, but very wisely advises intending users of these articles as to the conditions under which they may be expected to give satisfaction. The utterances of the department, respecting its own responsibility in the matter of affording sufficient day pressure for the successful working of gas apparatus, are sanguine as to its capability of pleasing everybody; though somewhat dubious on the point of the benefits it expects to derive therefrom in the immediate future, presumably on account of the leakage question. It may be hoped that the response to be obtained by the department to the question it has now put in a practical shape, as to whether the public will use gas by day if they can get it, will be such as to warrant its present action.

The useful series of lectures in connection with the Glasgow Exhibition of Artificial Lighting Apparatus has now been

brought to a close, and the exhibition itself has also run its course, after an existence, as we hope, of utility to the public and satisfaction to its projectors. Mr. A. Vernon Harcourt, M.A., F.R.S., who commenced the series of lectures by dealing in a popular manner with the question of domestic gas lighting, must be credited with making his subject clear to the most unpractical of his hearers, from the initial operation of the carbonization of coal, to the ignition of the gas therefrom at the consumer's burner. That "boss" puzzle to most gas consumers, the meter, was very happily explained by the lecturer, who in this as in his other detailed descriptions of gas apparatus, illustrated his remarks with examples drawn from the stands of various exhibitors.

Mr. Greville Williams, F.R.S., delivered the second lecture, on the subject of the coal-tar colours, of which there were several good collections in the exhibition. This lecture was of similar nature to that delivered by the same gentleman before the last meeting of the British Association of Gas Managers in June.

Dr. Stevenson Macadam delivered the fourth lecture, on the "Illumination of Lighthouses," in the course of which he did not express unbounded belief in the advantage of gas for this purpose, when it has to be specially made, chiefly, as it appears, on the grounds of uncertainty, and the trying nature of the work connected with the lamps. As against this view, we may be permitted to refer our readers to the report on the lighting by gas of one of the most important lighthouses in Ireland, part of which appeared in our last week's issue. This report has perhaps not been perused by Dr. Macadam, but in case he has done so, and still disagrees with the conclusions favoured by the Commissioners of Irish Lights, his reasons for so doing would be interesting, if expressed in detail. On the matter of labour in connection with the lamps, we feel sure Dr. Macadam is in error in believing that gas would be as troublesome to the lighthouse keepers as the dirty oil lamps, and we fail to see how the production of gas by means of small special plant could be considered at all uncertain, while the labour of making and delivering the gas to the burners, apparently deemed heavy by the lecturer, is of a very ordinary character indeed.

Mr. Fletcher's lecture on "Heating by Gas" was a strenuous plea for the convenience and economy of gas for purposes other than lighting, especially when used in Mr. Fletcher's burners and apparatus.

The concluding lecture, on "Lighting and the Transmission of Power by Electricity," by Mr. J. N. Shoolbred, was not remarkable for much original information.

Mr. Hunt's experiments on the relative diffusive power of globular and square lanterns, a brief account of which was given to the members of the Midland Association of Gas Managers at their last meeting, are another step in the investigation of the best means of street lighting to which Mr. Hunt has addressed himself. As a consequence of these experiments, Mr. Hunt states the advantage to be invariably with the round form, partly on account of the better regulation of the air supply, and also because of the directness with which the rays of light pass through the glass in lanterns of this shape. The appearance of the circular lanterns is, of course, much more ornamental, and the fact that they also give more light than the inelegant square lamps must be held to compensate, in a great measure, for their higher cost. As we shall probably before long have something more to say about Mr. Hunt's endeavours to improve the lighting of streets and open spaces by gas, we shall abstain for the present from more particular comment on his experiments.

The well-worn subject of leakage was threshed over again at the last meeting of the West of Scotland Association of Gas Managers, by Mr. Niven, of Dunoon, and the speakers who joined in the discussion on his paper. Mr. Niven does not believe in the permeability of iron pipes to gas, at least to any appreciable extent. In this he was not supported by the majority of the members present, although several curious facts respecting the wear and tear of mains, for and against his views, were brought forward. That some osmotic action goes on must, we think, be taken as an established fact, but there is little indisputable evidence as to its quantity under ordinary conditions. The question is complicated ordinarily by the leakage due to joints and valves, and it would be an interesting, though perhaps tedious labour to determine the facts of the phenomenon in some reliable manner.

Mr. R. Mitchell's paper, read at the same meeting, on the "Valuation of Gas-Works for Rating," shows the uncertainty which still prevails in many quarters as to the principle upon which the rateable value of such property should be ascertained. The sense of the paper is not so clear as it might be in the matter of the true basis upon which valuation should proceed, in comparison with the practice complained of by the author; but it at least shows the necessity for the universal acceptance of a definite rule. The pending arbitration in the Sheppy valuation case, to which we alluded last week, will serve to fix the method of procedure in accordance with the most enlightened modern practice, and will therefore be awaited with considerable interest by those concerned in matters of rating and the valuation of gas-works in all parts of the kingdom.

A case of personal interest to Secretaries and Engineers of Gas Companies recently arose in the course of the revision of the list of parliamentary voters for a suburban district. The name of the Secretary of a Gas Company was objected to "on account of his occupying Company's premises and not "paying rental." The claim was allowed by the Revising Barrister, on the ground that it was in no way essential to the due performance of his duties that the Secretary should reside on the Company's premises; and his residence being quite distinct from the offices of the Company, he had a right to a vote. The Revising Barrister, in giving the reasons for his judgment, stated as his opinion that if the Secretary had united with his duties those of Engineer to the Company, it would have been necessary that he should reside on the premises, and therefore he could not, presumably, possess a vote by virtue of such residence. But with all respect due to the authority in question, it is not by any means true that residence on the premises is essential to the due performance of the duties of Engineer to a Gas Company, many instances going to show the contrary. The *dicta* of Revising Barristers do not always agree in different revisions, but according to the reasons for the present decision, no Gas Manager or Secretary living on the premises of his employers can be rightly deprived of his vote.

A Limited Liability Company has been formed for the purpose of working up the rich material known to the chemical trade as "sulphur-oxide," in reality the spent oxide of iron used in gas purification, by a new patented process, which is said to take out the sulphur in a form as pure as the roll-brimstone of commerce, and to return the oxide as fit for use in the purifiers as when revivified in the ordinary way. The quantity of the material annually turned out of the Metropolitan gas-works, to say nothing of the larger provincial establishments, is so enormous, and it is so rich in sulphur, that any process treating it in an economical manner, and without destruction of the oxide base of the compound, should soon establish itself as a valuable industry, and would also help to illustrate the extraordinary modern development of the secondary or residual products of the manufacture of coal gas. We shall probably find occasion to describe the process in detail on an early date.

Water and Sanitary Notes.

THOSE parties who wish to have a share in the extraordinary prosperity of the New River Company will have an opportunity to-morrow, on the occasion of the sale by auction of sundry shares in that "grand and unique trading corporation," as we find it designated. A capitalist of moderate pretensions may purchase a fractional part of a share in the Adventurers Moiety, or, if he prefers it, a fraction of a share in the King's Moiety in this undertaking. There are also thirty new shares of £100 each to be offered for sale. The Company are described as deriving "from land and water" an annually increasing income, amounting last year to £424,097. The prospectus of the sale is worth studying, having all the appearance of being sufficiently inspired to render its utterances, if somewhat extravagant, at least suggestive. Thus we read: "Now that the purchase of the "Water Companies has been relegated to inquiry, no action "will be taken for years." It is also predicted that the income of the New River Company will inevitably be so advanced, that, whatever basis of calculation may be adopted, when the time for the purchase actually arrives "a much "larger sum will have to be paid to the Proprietors than "would have been the case under the defunct scheme "of the late Government." The prospect of any competing scheme is described as "simply visionary," and it is suggested that the New River Company could, from their own wells in the chalk, and with but acomparatively small outlay, meet "the dietetic requirements" of the whole

of London. This, of course, would necessitate a dual supply, which, we take it, is quite as visionary as competition. That the price proposed to be paid under the late Government Bill for taking over the New River undertaking was not excessive, is shown by a quotation from the evidence of the late Mr. E. J. Smith, who stated that the bargain was based on the market price of 1879, with an addition of ten per cent. "I reduced their terms as much as I could," said Mr. Smith, "and as these were under what I should have to give "with compulsion, I agreed." Altogether, the New River property has "an illimitable future." Of its marvellous growth in the past there can be no doubt, its income having doubled in the last fifteen years. The value of the land belonging to the Company is a speciality not to be lost sight of. The estates in London and in the counties of Middlesex and Hertford extend over hundreds of acres. The Myddelton Square Estate, consisting of over fifty acres covered with buildings, in the heart of London, is now let at ground-rents; but in about twenty-seven years time the leases will begin to fall in.

Lieut.-Col. Bolton, in his report on the Metropolis Water Supply for the month of September, repeats his complaint as to the deterioration of the water by the generally neglected state of the house cisterns. Hence the practical importance of the constant supply system, concerning which we observe that a member of the Newington Vestry has been summoned to the Lambeth Police Court for neglecting to provide proper fittings for the reception of the constant supply in a number of houses of which he is the proprietor. The Vestryman having no defence, abused the Company, whom he accused of having a "spite" against him. It appeared, however, that the Company had so far got the worst of it, as the Vestryman had managed to waste their water to the value of £25. As in thirteen months he had failed to execute the necessary works, he was allowed fourteen days longer. Irate under the pressure of the law, the defendant declared that "the days of the Water Companies were numbered, and "they knew it." We presume this gentleman is not one of the Vestry Delegates who will hold their adjourned meeting at St. Martin's-in-the-Fields to-morrow, when the lack of the constant supply will possibly be again mentioned as one of the crying sins of the Companies. Another matter, receiving passing reference in Lieut.-Col. Bolton's report, is that of hydrants, of which there are now 5383; but 3009 are for private purposes. Thus slowly does the public use of these appliances extend, for the purpose of protecting the Metropolis against fire. As many as 727 miles of streets have mains constantly charged, "and upon which fire hydrants "could at once be fixed." The "authorities" have only to give the word; but the word is not given, except in the City, and in a few limited cases elsewhere. The Corporation have written to the Metropolitan Board, stating that the system of fire hydrants in the City is now complete, and asking what the Board have done, as well as "what more" they propose to do, in order to utilize the said hydrants for the extinction of fires. Respecting the drinking supply of the last month, Lieut.-Col. Bolton states that the "organic matter," concerning which Dr. Frankland has been so perturbed, was principally due to "vegetation brought "down by flood waters." This is a common-sense view of the matter; but scientific analysis is nothing without carbon and nitrogen.

Science has rendered service to the Water Companies by demonstrating that milk, and not water, is the source of sundry painful epidemics. It may be suggested by the opponents of the Companies, that as milk often contains a considerable proportion of water, the accusation against the former does not exempt the latter. But we may unhesitatingly affirm that if the water supplied by the London Companies had been found in recent years to occasion one-half the mischief considered to be proved against milk, public indignation on the subject would have gone beyond all bounds. The inhabitants of the Metropolis are now warned that milk from Oxfordshire has conveyed scarlet fever to Paddington. Our readers may remember the case of the Town Crier of Derby, who was called to account for warning the people of that town to "boil the water" supplied from the town reservoirs. Dr. Stevenson, the Medical Officer of Health for Paddington, says nothing about the water, but he says, "Boil your milk."

The painful discussions which have been going on for some time past in the Manchester City Council, with reference to the irregularities in the keeping of the water-works accounts, have been at length apparently brought to a close. The duties of the department have been re-arranged, the outdoor work being separated from the indoor. The latter, including all book-keeping and financial matters, will be under the superintendence of Mr. Charlton, while Mr. Berrey will have charge of the outdoor operations. The report of the Committee which recommended these changes was unanimously adopted; but Alderman King signified amid considerable interruption, that he should have preferred a fuller investigation of the accounts. Mr. Berrey's salary undergoes a reduction by this new arrangement, but his duties will be materially lightened.

The Hillé system for the treatment of sewage has been adopted at Birkdale, and the works have been recently opened by a visit from the Local Board. Hillé's system is a combination of chemical treatment and filtration through land, or, in other words, precipitation and sewage farming. The plan has been found to answer very well in the case of several small towns, and has the reputation of treating the sewage effectually without creating a nuisance. Mr. Hillé has the merit of being a modest inventor, making no very great pretensions, but generally giving satisfaction. The sewage farm is not a necessary adjunct to his process, and where a large river is at hand, the effluent may be discharged direct from the depositing-tanks.

Last week we made reference to the method of burning town refuse invented by Mr. Alfred Fryer, of Nottingham, and adopted at Leeds and elsewhere. Some interesting details on the practical working of this invention have recently been laid before the Paddington Vestry by Mr. George Weston, the Superintendent of the Works Department. In accordance with instructions received from his Vestry, Mr. Weston visited Leeds, where Mr. Fryer's apparatus was at work, and made himself acquainted with its merits. There are two appliances concerned—one called the "carbonizer," and the other the "destructor." The carbonizer is adapted for the conversion of sweepings from paved streets, offal, vegetable and stable refuse, and all combustible waste, into a finely powdered charcoal, forming an effective manure and deodorizer, and selling readily at from 27s. to 30s. per ton. The ash withdrawn from the furnace sells at 2s. 6d. per load. The Leeds carbonizer is a brickwork structure containing eight cells or furnaces, each cell carbonizing fifty hundredweight of material in twenty-four hours, the fuel used for the furnace consisting of soft core and rough dust. The destructor is also built of brick, securely tied with iron, and has six furnace cells. The contents of dustbins and middens, with garbage of all kinds, are tipped into the furnaces from a platform at the summit. At intervals of about two hours, clinkers, iron pots, tinware, broken pottery, fused glass, and other incombustible matters, are withdrawn at the foot, and a further charge of refuse is shovelled in at the top. Each of the six cells is capable of destroying seven tons of materials in twenty-four hours; that is to say, the process of destruction goes so far as to reduce the bulk to about one-sixth, and the weight to about one-fourth. One cell in two is provided with an opening for introducing directly on to the fire infected mattresses and bedding, diseased meat, and other unwholesome articles. The gases generated in the combustion which goes on inside the destructor are all made to pass into the fire, so as to avoid any risk of their conveying infection to the neighbourhood. The waste heat on its way to the chimney-shaft passes through a multitubular boiler generating enough steam to drive a fourteen-horse power engine, working two mortar-mills. The clinkers mixed with lime are ground into a highly tenacious mortar, selling at 5s. per ton, as stated last week. The tin pots, cans, and other matters, sell at 20s. per ton. It is stated that throughout the whole process, whether of charging, burning, or withdrawing, no unpleasant odour escapes; neither does the chimney emit smoke. All the town refuse is thus disposed of without any nuisance to the neighbourhood. The carbonizer and destructor are worked night and day, the furnaces not being allowed to go out more than three or four times in the course of a year. This system of dealing with town refuse is understood to be extending, and is already in operation, in a greater or less degree, at Manchester, Birmingham, Rochdale, Stafford, Heckmondwike, Blackburn, Bradford, Bury, Warrington, and Jarrow, as well as at Leeds. We presume Paddington will soon be added to the list. The Leeds apparatus cost £4270, to which has to be added a royalty of £150 to the patentee, and £1460 for the land.

THE STOCKTON AND MIDDLESBROUGH CORPORATIONS WATER BOARD.—On Wednesday last a private meeting of this Board was held at Middlesbrough. After considerable discussion it was agreed to recommend the Town Councils of Stockton and Middlesbrough to go to Parliament for powers to carry out what is known as Mr. Mansergh's No. 2 scheme, which, for obtaining an additional supply of water, will involve another outlay of about £200,000.

GAS LEGISLATION FOR 1880.

We commence to-day our usual annual abstract of the Acts of Parliament passed each session, having reference to gas and water supply, &c., by noticing that during the sessions of 1880 only two Gas Companies were incorporated with statutory powers, as compared with five so incorporated in 1879. Both Companies are located in Yorkshire. The Acts contain the following provisions:—

The *Ackworth, Featherstone, Purston, and Sharlston Gas Act* dissolves and re-incorporates a limited Company formed in 1873 for the supply of gas to the places named. The original capital of the Company was £10,000, divided into 2000 shares of £5 each, and there was no mortgage debt. The capital of the incorporated Company is to be £30,000, whereof £10,000 is to be called the original capital, and £20,000 is called the additional capital. The original capital is divided into 1000 shares of £10 each, and the Company are to convert into stock the whole or any part of their original capital when fully paid up, and may issue as stock, or convert to stock when paid up, the whole or any part of the additional capital; the additional capital is to be issued as required in the form of new ordinary or preference shares or stock, of not less than £10 unit value. Not more than £4000 worth of new shares or stock is to be issued during any one year, but the rate of issue may be average over several years, so as not to exceed that amount per year, although not actually created in every year. The Company are also empowered to borrow £2500 on mortgage in respect of the original capital, and also to raise on loan in respect of the additional capital any sums not exceeding one-fourth of the amount of such capital actually issued and at least half paid up. Money so borrowed may be converted into capital, provided the dividends to be paid on the same are limited to five per cent. per annum. The Company may also create and issue debenture stock. The standard dividends of ten per cent. on the original capital, seven per cent. on the additional capital, and six per cent. on any preference capital, are provided, and the sliding scale is imposed with an initial price of 5s. 6d. per thousand cubic feet. The auction clauses are also enforced for all issues of new capital, with the usual provision for the application of the premiums realized. The formation of an insurance-fund, with an annual appropriation of one per cent. on the paid-up capital, is also authorized, such fund to be made up to one-twentieth of the paid-up capital for the time being. Surplus profits after payment of dividends and insurance are to be carried forward, except, by reason of a reduction in price, increased dividends are payable, and in that case a reserve-fund may be formed, at the discretion of the Company, which will be available for the purpose of equalizing dividends. The Company may manufacture and sell residuals, and manufacture, purchase, hire, or sell and lend gas-fittings and stoves, or take out licences for the use of patented inventions. Gas is to be supplied at a pressure of six-tenths from midnight to sunset, and eight-tenths from sunset to midnight, of fourteen candles illuminating power, as tested by Sugg's "London" Argand, No. 1, and a testing-place is to be provided at the works. Interest is to be paid on money deposited as security by consumers. The usual formal clauses are inserted for continuing the rights, powers, and liabilities of the limited Company to the incorporated Company.

The *Malton Gas Act* dissolves and re-incorporates the Malton Gaslight and Coke Company, which was formed under a deed of settlement in 1836, for lighting with gas the town and vicinity of New Malton, in the North Riding of Yorkshire, and was subsequently registered under the Companies Act, 1862, but not as a limited Company. The share capital of the Company stood, when the present Act was passed, at £24,000, divided into 2000 shares of £10 each, all allotted, and £18,067 10s. paid up, leaving £5932 10s. to be called up; and the registered Company had not borrowed any money on mortgage or debentures, and had no debts. The Act fixes the original capital of the Company at the amount of the old shares, and permits the raising of additional capital to an equal amount by the issue of new ordinary or preference shares or stock; and £4000 of the new capital may be issued during the year following the passing of the Act, and an average of £3000 in each subsequent year. The auction clauses are enforced for all issues of new capital. The Company may raise on mortgage the total sum of £6000 on the old capital, and an equal amount on the additional capital, provided that the aggregate amount so borrowed shall not at any time exceed one-fourth part of the amount of such additional capital paid up for the time being. No moneys so borrowed shall, if converted into stock or shares, receive more than five per cent. per annum. The dividends on the additional capital are limited to seven per cent., or six per cent. on preference capital, and the sliding scale is applied with an initial price of 4s. per thousand cubic feet; a one per cent. appropriation for an insurance-fund being authorized, and a discretionary reserve-fund also permitted when the rates of dividend are increased. The Company take general powers to manufacture and sell residuals, and to let on hire gas-fittings, &c. Power for taking additional land to the extent of two acres, when required, is also granted, but not for the purpose of manufacturing gas or residual products thereon. Fourteen-candle gas is to be supplied at six and eight tenths pressure, from midnight to sunset and sunset to midnight respectively. Sugg's "London" Argand burner, No. 1, is to be used for testing, and a testing-place is to be provided at the works within six months. Interest is to be paid on money deposited as security by consumers. The usual formal provisions are included in the Act.

Two Acts affecting Metropolitan gas undertakings were passed during the sessions, one being the Bill of the Corporation of the City of London and the Metropolitan Board of Works, in accordance with the provisions of the Metropolis Management Act, 1855; and the other an application by the London Gaslight Company for special powers.

The *Gaslight and Coke and other Gas Companies Acts Amendment Act* is an Act to make further provision for regulating the supply of gas by The Gaslight and Coke Company, the Commercial Gas Company, and the South Metropolitan Gas Company, and to amend the Acts relating to the said Companies. It chiefly relates to the official testing of the gas supplied by the Companies, and repeals and re-enacts in a concise form certain sections of their different private Acts. The Gas Referees are empowered to visit the testing-places, and ascertain the condition of the testing apparatus. The Referees are also instructed to prescribe the mode to be adopted for testing and recording pressure, and the tests are to be made as and where appointed by the controlling authority. The fine for deficient illuminating power remains at 40s. for the first half-candle; but is made for the first and every subsequent candle a sum not less than £25 and not exceeding £100. The fine for excess of impurity is still £50, but only one such fine can be recovered from one Company on any day. The fine for insufficiency of pressure is also made recoverable for only one default in any period of 24 hours. Reservation is made in favour of the Companies in cases of defect arising from unavoidable accident. The costs of obtaining the Act are to be paid by the Corporation and the Metropolitan Board.

The *London Gaslight Act* authorizes the Company to buy or hire, and to supply, sell, or let to consumers of gas within their district, burners, tubes, stoves, or ranges for cooking by gas, and any other domestic gas-fittings, and also gas-engines and motors, and all necessary fittings and machinery for use in connection therewith; and to charge such price, rent, or sum for the same as may be agreed upon between the parties. The Company take powers to obtain licences for working patented inventions, and to use any process in connection with the manufacture or distribution of gas, and for the conversion and utilization of residuals. Separate accounts are to be kept of all business done under the Act, and a capital of not more than £20,000 may be employed for the purposes recited.

(*To be continued.*)

THE USE OF GAS IN LIGHTHOUSES.

(*Concluded from p. 648.*)

It will be remembered that when we left this subject last week, we had carried the correspondence that has recently taken place, between the Board of Trade, the Trinity Board, and the Commissioners of Irish Lights, respecting the improvement of the light on Copeland Island, down to the time when the Board of Trade had replied to the statement placed before them by a deputation of the Irish Commissioners, and asked for a revised estimate to be sent them of the first cost of introducing gas at Copeland Island (including the first cost of a fog signal), and also of the annual cost of maintenance. To this request Mr. W. Lees, the Secretary to the Commissioners, replied, on the 10th of April last, in the following terms:—

I am directed by the Commissioners of Irish Lights to forward, for the information of the Board of Trade, the statement Mr. Wigham, in answer to the criticisms passed upon his calculations relative to the cost of gas in its various forms, which appears to the Commissioners to explain so very clearly the apparent discrepancies between Mr. Wigham's former statement and the remarks made on it by the Board of Trade, that they feel they have nothing to add to it.

I am, however, desired to observe that the allegations of the Board of Trade relative to the very much greater average cost of the six lighthouses in Ireland where gas has been introduced, compared with the cost of maintaining a station where mineral oil is used, have caused the Board to inquire closely into the relative actual cost of lighting with gas and oil.

The Board have not any 6-wick burner oil lamp, and they cannot, therefore, from their own accounts, institute any comparison between gas and

oil applied in that form; but they have compared the average actual cost of lighting three first-class mineral oil lights with 4-wick burners, being the only lights of that sort which have been in use for more than twelve months, viz.:—Killybegs (St. John's Point), Ballycotton, Kinsale (Old Head); and five similar first-class gas lights, viz.:—St. John's Point (County of Down), Rock-a-Bill, Hook Tower, Wicklow Head, Minehead (Howth Bailey being omitted in consequence of the many gas experiments that have been made there); and the result of their investigations is as follows:—

Average actual cost of maintaining five gas-lighted stations with a maximum of 2923 candles, for the year ending March 31, 1879	£364 13 8
Average actual cost for the same period of maintaining three stations lighted with 4-wick mineral oil lamps, with a maximum of 328 candles . . .	297 8 9
Excess of gas	£67 4 11

The above comparison is made with respect only to the annual cost of maintaining each description of light. The original outlay for erecting the gas apparatus is larger than that for the appliances necessary for oil; but the Commissioners are of opinion that the superior efficiency of the former illuminant, capable of instantaneous increase, in emergency, from 429 to 8769 candles, as against 722 candles (the highest illuminating power obtained from oil), entirely justifies, in the case of important lights, the additional first cost and the increased amount of annual maintenance.

With respect to the Copeland Island light, the estimate of Mr. Douglass (the Board's Engineer) for erecting the necessary works for an oil lamp (6-wick burner), with siren and caloric engine, was, in Dec., 1878, £8470 13s. 2d., and for a gas (one light), with gas siren, £9437 6s. 9d.

On revision, Mr. Douglass now thinks that, in consequence of the rise in the price of metals, the estimate for a mineral oil light should be increased by £140, making it now £8610 13s. 2d., and for a gas station should be increased by £195, making the estimate now £9632 6s. 9d.

Mr. Wigham's tender for the whole expense to be incurred in lighting with a triform gas light and gas siren, as in his proposal of Sept. 18, 1879, is	£8930
Less if allowed to utilize an existing house of which the Board approves	500
	£8430
Appliances for lighting "Mew" Island and "Briggs" Rock, and providing a temporary light to be used during the construction of the works, of equal power with the present light, as since suggested by the Board	475
	£8905

The comparison of mineral oil with gas cannot be fairly instituted, without taking into account the enormously increased power which can be obtained with facility, and instantaneously, in the use of the latter light.

For lights in less important positions, mineral oil may answer, but for grand leading lights, or in particularly dangerous localities, there can be no question as to the superiority of gas as an illuminant; the utmost extent of illumination of mineral oil being 722 candles, while that of gas attains, in quadriform system, to 8769 candles.

In clear weather a very low amount of illuminating power is sufficient to show on the horizon, such as that of a 4-wick mineral oil burner, or its equivalent, a 28-jet gas-burner; but when danger really is imminent, and the highest amount of illumination known is required to save life and property in dense fog, then gas comes to the front, transcendently effective, throwing out through the fog (and when unable to pierce it, illuminating it) a light of 8769 candles, while the 6-wick mineral oil burner is choked and buried with its modicum of 722 candles. In support of this statement, the Commissioners think it will be interesting to the Board of Trade to have before them certificates from practical mariners as to the efficiency of the gas light.*

The principle the Commissioners have invariably tried to carry out to the utmost of their power has been lately ably advocated by Mr. Farrer in his evidence before a Parliamentary Committee, where he stated that "The cost of a lighthouse is as nothing compared with its value to the mariner;" and added that "This was not only his own opinion, but the principle upon which the Board of Trade deals with such expenditure." Considering, therefore, the immense superiority of the illuminating power of gas under those foggy conditions of the atmosphere so frequent around our coasts, when the lives of the crew and the safety of the cargo are in the balance, and everything depends upon a glimmer through the surrounding darkness for the salvation of life and property, the Commissioners feel a confidence that the Board of Trade will no longer hesitate to grant them authority to proceed at once with a gas triform illumination at Copeland Island.

Mr. Wigham, in the letter mentioned above, writes as follows:—

I think the Board of Trade will find, on looking further into the parliamentary papers to which they refer, that my statement is not incorrect; but that they have fallen into the error of supposing that the sum of £186 9s. 4d. represents the annual cost of a 28-jet burner consuming 51·4 cubic feet per hour, the consumption of the establishment being on an average 120 feet per hour. Mr. Valentin gives the true cost—viz., £115 18s. 10d.—and says: "The real advantage of the Wigham gas-burner consists not so much in its furnishing a somewhat cheaper light equal in power to the oil light now in use, but in its capability of producing lights of varying illuminating powers, some of which have never been, and probably never will be obtained by oil lights; also in its adaptability for flashing purposes and signal lights. The higher-power lights come so much cheaper because the cost of making larger quantities of gas, which is represented by wages, interest on plant, &c., remains pretty well the same. It is here, in fact, where its undisputed advantage lies. This becomes clear at once if the hourly consumption of gas be taken as 120 cubic feet, a consumption which both Mr. Douglass and Mr. Wigham are agreed upon will be sufficient for clear as well as foggy weather." Dr. Tyndall says in reference to this subject: "There is one point in connection with the 28-jet burner only, which, in justice to its inventor, I must here signalize. Anxious to give the Elder Brethren the maximum of information, Mr. Valentin has stated, in a table, the cost of the 28-jet burner, supposing it to be pitted at Haisbro' against the 4-wick lamp. In that table he debits the small burner with the whole of the gas-makers wages, and with the whole of the interest on £1685 6s. 9d. Now the gas-maker is there not to produce gas for a 28-jet burner only, but for a series of fog burners culminating in one of 108 jets. He manufactures not 51·4 feet an hour, but an average of 120 cubic feet an hour. Were it, moreover, proposed to erect works for a 28-jet burner, an idea to my knowledge not entertained, a fraction of £1685 6s. 9d. would cover the cost." It will therefore be seen that the Board of Trade are mistaken in supposing that the annual cost of the triform burner at Copeland, when three 28-jets are used for foggy weather, would be £207 4s. 2d., and when three 48-jets are used £232 9s. 9d., the real cost being £162 16s. and £212 6s. respectively, as stated by me.

With respect to the general question of the cost of gas as compared with oil, it was shown at Haisbro' that gas was much cheaper than colza oil, even without taking into account its superior illuminating power. I thought it was clearly understood that the investigation at Haisbro', which was ordered by the Board of Trade, was to be considered final and conclusive on that point. I believe that Dr. Tyndall, Mr. Valentin, Mr. James Douglass, and myself, endeavoured to make it so, and took great pains to demonstrate the true cost, not on any theoretical basis, but by actual practice, and with this view the process of manufacture was carefuly watched and noted day after day for a very considerable time. I am perfectly confident that the cost of using gas for lighthouses was then really arrived at, of course subject to variation in the price of coal, &c., and if, as stated by the Board of Trade, the accounts of six gas stations in Ireland show a greater cost than stations where mineral oil is used, gas being charged with interest upon the original outlay, and the money paid to me for patent rights, I can only suppose, in the absence of any data as to the nature of this excess—1st. That perhaps the system of manufacture originally fixed upon at Haisbro' is not adopted. [You are aware that some time since I formally offered to secure this, and ensure that the proper cost should not be exceeded, by contracting to supply gas at all your stations, and I am still willing to enter into some such arrangement, should you think it desirable.] 2nd. That the cost of preliminary experiments, as well as the cost of patent rights, is included in what the Board of Trade term original outlay. This, I think, bears more hardly on gas than on oil lights, with which from time to time there have also been many experiments, without, so far as I know, debiting them with interest. But even supposing it is considered right to adopt this course, and that there is this excess of cost, which, in my mind, ought not to exist, I respectfully submit that the sum of £129 which the Board of Trade say is the excess of gas over mineral oil (6-wick burner) is not extravagant when the greater illuminating power of the gas is taken into account. The 4-wick lamp is quite sufficient to show light at the horizon to the mariner in clear weather, and it is evident that it is only in thick weather that a superior light is required. The Board of Trade have recognized this in sanctioning the use of the 6-wick lamp in place of the 4-wick lamp, at an increased annual expenditure of £91 to gain a maximum increased illuminating power of 394 candles—the difference between the illuminating power of the 4-wick and 6-wick lamps. It is perhaps, therefore, not unreasonable for me to suppose that they should not object to an expenditure of this £129 to secure a further increased illuminating power of 2201 candles (the difference between the maximum illuminating power of the 6-wick lamp and that of the gas lights in Ireland), especially when for a very small additional cost they may secure, by the use of the triform, a greater light than that of the 6-wick oil lamp by more than 8000 candles. You are aware that these figures as to illuminating power are not mine, but are those fixed at Haisbro', as was also the table of cost upon which my statement as to cost, which includes interest on outlay and all renewals of apparatus, is based.

The following is a summary of the revised estimate of cost for which the Board of Trade asked, the particulars being set forth:—

Estimated Cost of altering present Light to a First Order Fixed Dioptric Light.—Cost of Works for Burning Gas in a 28-jet Burner, in Triform, with a powerful Siren driven by a Gas Engine; and for Burning Mineral Oil in a 6-wick Burner, with a powerful Siren driven by a Caloric Engine.

—	Gas (28-jet Burner in Triform, with Siren driven by Gas Engine).	Mineral Oil (6-wick Burner, with Siren driven by Caloric Engine).
Cost of works	£10,338 18 0	£8610 13 2
Annual maintenance	£518 18 2¾	£348 2 6
Ordinary repairs	157 18 2	138 9 4
Special repairs	133 9 5	121 9 2
Totals	£810 5 9¾	£608 1 0

Accompanying Mr. Lees's letter, given above, was a statement—prepared by Mr. Douglass for the information of the Deputation from the Irish Lights Commissioners to the Board of Trade—showing the estimated cost of a 28-jet triform light, with fog signal driven by a gas engine, for Copeland Island, based on the average amount of extra gas consumed during fog at three stations. Mr. Douglass says:

This extra amount is very much below the amount usually estimated, my calculation being for the single burner, using the 28-jet in clear weather, the 68-jet for 360 hours, and the 108-jet for 360 hours, 158,400 cubic feet, whereas the average amount for Hook Tower, Minehead, and St. John's Point is only 22,697 feet. Therefore, as the coal for the single burner system was an average of the quantity used at five stations, I have added the latter amount only to that consumed by a single 28-jet burner for 3692 hours of clear weather. Thus—

	Cubic Feet.
3692 hours clear, at 50 cubic feet per hour	184,600
Amount actually consumed during fog at three stations .	22,697
Total quantity	207,297
Total for triform system	274,600
Increase for triform	67,303

If the full estimated quantity for fog was burnt at the different stations, there would be a decrease in favour of the triform system of 68,400 cubic feet.

Some correspondence afterwards took place as to some minor details of the tender sent in by Messrs. J. Edmundson and Co. for executing the necessary work, and these having been arranged, the following letter (which closes the correspondence) was sent by Mr. T. H. Farrer, on behalf of the Board of Trade, to the Commissioners of Irish Lights:—

I am directed by the Board of Trade to acknowledge the receipt of your letter of the 10th ult., further on the subject of the proposed improvement in the lighting of Copeland Island, Belfast Lough, and more especially on the comparative cost of gas and oil employed as illuminants.

The Board have carefully considered the observations of the Commissioners of Irish Lights on this subject, the further communication of Mr. Wigham, the relative estimates and tenders, and the remarks of Mr. W. Douglass thereupon.

* Letters from 11 sea captains are published, all bearing out this statement.

I am now to state that under all the circumstances, and having regard to the representations of the Commissioners, the Board of Trade sanction the establishment of a gas light and siren fog signal at Copeland Island, and are prepared to approve of the necessary outlay, estimated by Mr. Douglass to amount to £10,338 18s., for carrying out the alterations in the present light, and construction of the requisite gas-works.

The Board of Irish Lights, it will thus be seen, gained their point; and, looking at the facts brought out in the course of this interesting correspondence—the cheapness of gas compared with paraffin oil, besides its very much greater illuminating power—it appears strange indeed that the Board of Trade should have had any hesitation in adopting a light so enormously superior in illuminating power, and of such small cost, as gaslight for lighthouses has now been proved to be.

Notes.

[This column is intended to contain miscellaneous memoranda on topics of general professional interest to our readers. We shall be glad to receive for insertion in it any scraps of information, observations of facts, or descriptions of apparatus, &c., which may be worth publication, and yet may not be considered suitable for our "Correspondence" column.]

A Colour Test for Ammonia.

Professor R. B. Webster, of Norfolk, Virginia, described at the recent Boston meeting of the American Association for the Advancement of Science, a process for the quantitative analysis of ammonia solutions by a solution of ferric gallate and ferric oxalate. A solution of ferric sulphate is first prepared, and having been decomposed by the addition of gallic acid, the resulting black ferric gallate is further partially decomposed by oxalic acid, until the colour is reduced to a bluish-black tinge. A suitable quantity of the reagent thus obtained is added to a solution of free ammonia, or carbonate of ammonia, in the same way that Nessler's solution of mercuric per-iodide is used in Wanklyn's process. The result of this mixture is the combination of the ammonia with part or all of the oxalic acid of the colourless ferric oxalate of the reagent, and the blackening of the solution by the re-forming of ferric gallate. The practical estimation of ammonia by this process is by an imitation of a standard solution of ammonia with the reagent, as in Wanklyn's mode of Nesslerizing. When the solution to be tested and the imitation solution correspond in colour, it is inferred that they contain equal quantities of ammonia. In this process the standard ammonia test solution should be made from the carbonate, and may be of such strength that one litre shall contain one milligramme of ammonia, or one part in a million. Another and more direct way of estimating ammonia is by adding a standard test solution of oxalic acid to the blackened solution of the reagent and liquid to be tested, till the original colour is produced, and from the known quantity of oxalic acid used, to calculate the quantity of ammonia in the resulting oxalate. This method is described as convenient and sensitive.

The Enrichment of Coal Gas by Petroleum Gas.

A correspondent of the *American Gaslight Journal* gives some particulars respecting the use of petroleum for enriching coal gas; and incidentally refers to the result of attempts on the part of some American gas companies to use mineral oil as a gas-making material in the place of coal. It is natural that, with such vast supplies of petroleum at hand, gas companies favourably situated with respect to the oil wells should have had their attention seriously occupied with the practicability of producing gas economically from liquid hydrocarbon; but the experience of a great number of these companies has not been conducive to the spread of petroleum gas manufacture. Our contemporary's correspondent states that in consequence of a sudden rise in the price of coal last spring, a thorough trial of petroleum as an auxiliary was determined upon by the president of the company with which he was connected, and the results he obtained at that time were not discouraging. With coal yielding 10,371 cubic feet of 16·1-candle gas per ton, he used oil of 57° specific gravity, and with 32·8 gallons of this oil to the ton of coal he produced 15,704 cubic feet of 17·7-candle gas; and with 39 gallons of oil to the ton he obtained 14,672 cubic feet of 18-candle gas. The first of these results is the average of eight days, and the second of twelve days trial. Making gas from the oil alone, and reducing its illuminating power with air, was tried, but soon discarded as a hopelessly extravagant proceeding. As the first of the two recorded trials proves, the difference between 10,371 cubic feet of 16·1-candle power, and 15,704 cubic feet of 17·7-candle power, or an increase of 5333 cubic feet of 17·7-candle gas, was due to the 32·8 gallons of oil, besides the raising of the remaining 10,371 cubic feet originally due to the coal from 16·1 to 17·7 candle power, or an increase of 1·6 candles. The value of the oil is therefore 168·2 cubic feet of 17·7-candles gas per gallon. The company in question are now working constantly with oil or naphtha of 71° specific gravity, and with still better results. The necessary arrangements for making the oil gas are described as being extremely simple and non-patented, consisting principally of a piece of 3-inch pipe and a few fire-bricks, forming a retort and furnace.

Artificial India-Rubber from Coal Tar.

According to *Ackermann's Gewerbezeitung*, an inexpensive and efficient substitute for india-rubber or gutta-percha has been found. It can be used, either alone or in combination with resinous substances, as an electrical insulator, or for other purposes for which the genuine materials named have alone been suitable. The composition is elastic, tough, not so sensitive to external influences as india-rubber or gutta-percha, and is not injured by pressure or high temperature. The base of the compound which possesses these remarkable qualities is coal tar oil, or equal parts of coal and wood tar oil, in quantity equal to a third part of the whole mixture. This tar oil is poured into a large kettle, together with an equal quantity of hemp oil, and is heated for several hours, either by steam or over an open fire, to a temperature ranging from 252° to 288° Fahr., beyond which it must not pass. The mass becomes at length so ductile that it can be drawn out in long threads, and the remaining third portion, consisting of linseed oil which has been thickened by boiling, is then added. With this compound from 5 to 10 per cent. of ozokerite and some spermaceti should be mixed; after which the mass is heated again for some hours at the same temperature as before, and finally from 7 to 12 per cent. of sulphur is added. The composition is then cast in moulds and worked up the same as india-rubber. By slightly varying the proportions of the three oils of which the substance is principally composed, its character may be modified in various ways according to the practical purposes for which it is required.

The Temperature of Flames.

In the *Annales de Chemie et de Physique* there have recently been published the results of some experiments carried out by Mons. F. Rosetti to determine the respective temperatures of the flames of (1) an ordinary gas-burner; (2) a Bunsen burner; and (3) an electric light generated by means of a thermo-pile and a delicate reflecting galvanometer. With the temperature of the air at 59° Fahr. (15° C.), the ultimate temperature of the white flame at the outer edge of an ordinary gas-burner was 2370° Fahr., while that of the interior blue flame was 2100° Fahr.; the average temperature of the flame being fixed at 2170° Fahr. The ultimate temperature of the flame of a Bunsen burner was determined to be 2280° Fahr. The electric light gave as a maximum intensity of heat: For the positive pole, 7050° Fahr.; for the negative pole, 5700° Fahr.; for the arc itself, 8700° Fahr. In reference to these results, "B," writing in the *Journal of the Franklin Institute*, from whom the above is quoted, says: "There is still wanting an accurate measure of the *quantity* of heat emitted by the electric light to compare with the heat equivalent of the electro-motive force expended in the arc, and thus to eliminate the expenditure of heat in the production of light."

The Absolute Invisibility of Atoms and Molecules.

Atoms and their aggregates—molecules—are being constantly mentioned by chemists and physicists, and the interest necessarily attaching to these ultimate subdivisions of matter may be held to excuse a natural curiosity as to whether they will ever be made visible to the human eye. Dr. Dolbear essays to answer this inquiry in the negative, in a recent number of *Science*, an American publication. According to the note in question, Mulder states that a molecule of albumen, selected as a typically complex substance, contains 900 atoms; and a molecule of alum contains 100 atoms. Assuming that atoms arrange themselves into molecules in agreement with the three dimensions of space, and that a good microscope of modern construction will define the 4000th of a millimètre, a microscope of fifty times greater power would render a molecule of albumen visible, or if its power could be increased 107 times, it would enable one to see a molecule of alum. According to Helmholtz, it is probable that interference will limit the visibility of small objects; but if he should be in error, Dr. Dolbear states that there are two other conditions which will prevent our ever seeing a molecule. First, the motion of molecules is extremely rapid. A free molecule of hydrogen at the temperature of zero (centigrade), and at a pressure of 760 millimètres of mercury, has a free path about the 10,000th of a millimètre in length, and a velocity therein of more than a mile per second. As only a glimpse of an object moving no faster than one millimètre per second could be obtained by the microscope, the rate of motion as stated would render the moving molecule quite invisible. Again, supposing a molecule could be held in the field of vision so that it could have no free path, it still has a vibratory motion which constitutes its temperature. The vibratory motion is measured by the number of undulations per second it sets up in the ether, and will average 5000 millions of millions—a rate of motion that would make the space occupied by the molecule visibly transparent; that is, it could not be seen. The transparency of the molecule is the second reason for its absolute invisibility. From the small obstruction to light and heat offered by the atmosphere, signifying little power of absorption on the part of its constituent gases, Dr. Dolbear argues that their separate molecules would be too transparent to be seen, even though their magnitude and motions were not absolute hindrances.

American Gaslight Association.—From the issue of the *American Gaslight Journal* of the 16th ult., received by yesterday's mail, we learn that the eighth annual meeting of the American Gaslight Association was held in Chicago, Ill., on the 13th, 14th, and 15th of October. The chair was occupied by the President, Mr. Wm. H. Price, of Cleveland, Ohio. The meeting was one of the largest and most complete that was ever held by the Association, 125 members being present. The following gentlemen were unanimously elected as Officers of the Association for the ensuing year:—President—Wm. H Price; Vice-Presidents—A. Hickenlooper, Theobald Forstall, Wm. A. Stedman; Secretary—Wm. Henry White; Finance Committee—John S. Chambers, A. B. Slater, Geo. S. Hookey; Executive Committee—Henry Cartwright, F. C. Sherman, A. C. Wood, Peter T. Burtis, T. Littlehales, Samuel Pritchitt. The President's address was very able and thoroughly practical, and well suited to the times. The papers read treated of the following, among other, subjects:—"Stopped Stand-Pipes," "Mechanical Stoking," "Furnaces," "Burners," "Gas-Engines," "Illuminating Power for Compensation," "Coal Tar," "Heating by Gas," and "Water Gas."

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

MR. G. LIVESEY ON THE ECONOMY OF CARBONIZATION.

SIR,—Having read with much interest Mr. Livesey's article on the important question of the "Economy of Carbonization," and the correspondence to which it has given rise, I would ask you to allow me to contribute a few remarks on the subject.

In your last issue Mr. Sidney E. Stevenson gives an estimate of the result of producing an extra 500 cubic feet of gas per ton of coal carbonized, which at first sight appears to differ widely from the previous calculation of Mr. Livesey; but this difference is mainly due to Mr. Stevenson taking the *selling* price of the extra quantity, instead of its *cost* price. Instead of estimating the additional cost of the increased quantity of cannel necessary to maintain a fixed illuminating power, I would suggest another mode of arriving at the result of an increased make—namely, by calculating the number of candle units obtainable from the same coal, on the assumption that 9800 cubic feet of 16-candle gas, or 10,300 cubic feet of 15½-candle gas, can be extracted, thus :—

9,800 × 16 = 156,800 candle units.
10,300 × 15½ = 159,650 „

showing a gain of 2850 candle units from the increased make; and taking the net cost of the coal, less residuals, at 6s. 8d. per ton, which is the last year's average of the Metropolitan Companies, this gain of 2850 candle units would represent a money gain of about 1½d. per ton. I think after deducting from this the extra cost of fuel, wear and tear, &c., consequent upon higher heats, very little will be left, if the balance is not found on the other side.

This is, of course, viewing the question only from the point of higher heats giving an increased yield. Mr. Livesey very justly says that there is a clear gain, if an increased yield can be obtained from improvements in working; but I very much doubt whether high heats are to be classed under such improvements, and I quite agree with him that there must be "an economical maximum" beyond which it will not pay to go.

In your number for Oct. 19, Mr. G. E. Stevenson says that rapid carbonization, by means of high heats and light charges of short duration, evolves more light-giving constituents than slow distillation. This is undoubtedly true to a certain extent; but there must be a limit. It may be admitted that short light charges have this effect, but how far the addition of high heat contributes to it, is still doubtful to me; and against the benefits of short light charges, the extra cost of labour has to be considered. In my own experience, I have tried four and five hour charges, with hand labour, and have found it better to return to six-hour charges; but it is very possible that mechanical stoking may help to make shorter and smaller charges practicable, with improved results.

C. GANDON.

Crystal Palace District Gas-Works, Lower Sydenham, Oct. 30, 1880.

SIR,—The question propounded by Mr. George Livesey, in your issue of Oct. 12, appears to have created quite a commotion amongst his colleagues; and it is to be hoped that it will be discussed in the interests of gas consumers as well as gas companies. If gas engineers can produce a better article, and supply it at a lower price than exists at present, they will confer a benefit on the public as well as on the gas companies shareholders.

It is admitted by some of your correspondents, who are practically engaged in the manufacture of gas, that the existing system might be improved both as regards the distillation of coal and the qualities of coal commonly used in its manufacture. You will scarcely find two gas engineers agreed as to the quality of any particular kind of coal, and "who shall decide when doctors disagree?"

It is evident, however, that Mr. Livesey's bias inclines in favour of distilling coal at a comparatively low heat; with the specific object of obtaining a better quality of gas, at some sacrifice in the quantity produced per ton of coal. I am of opinion that he is quite right. I believe that the distillation of coal at an excessive heat is not only destructive to the retorts and furnaces, but that the gas evolved in the later stages is of a very inferior quality; as are also the tar and ammoniacal liquor. The quality of the coke must also be seriously affected thereby. I am strongly inclined to the belief that if gas engineers would content themselves with a yield of about 9500 cubic feet of gas per ton of Newcastle coal, they would obtain better results. The gas would undoubtedly be of a superior quality; and so, I believe, would be the coke and tar.

The chief objection to the use of coke for domestic purposes is the difficulty and expense of getting it fairly alight in an ordinary fire-grate. When this is accomplished, another drawback occurs, for in a few minutes the fire dies away for want of substance or body in the coke; and, although it is hot, clear, and strong for a short time, yet it lacks the cheerful blaze and lasting power of a coal fire. This defect may, I think, be fairly attributed to the "sweating" the coal is subjected to in the retorts, with the results before mentioned. If coke were improved in quality, a good deal more of it would be used in London, and we should probably obtain the benefit of an improved atmosphere in addition to increased domestic comfort.

Returning to the debateable question of coals most suitable for the manufacture of illuminating gas, I would observe that (although it may be considered presumption on my part to say so), as gas engineers are not at all agreed on the point, they might perhaps find it advantageous to get out of the groove in which they have so long been running, and strike out a new course. Mr. Henry Woodall's letter in your issue of Oct. 22 plainly indicates the direction in which this course lies. By confining themselves to a particular colliery or district, gas companies do not derive the benefit which would probably accrue from a healthy competition amongst coalowners generally, if they felt assured that their produce would be fairly tested on its merits. Mr. Woodall refers to the possible exclusion of such qualities as unscreened coal, nuts, or slack, which latter is understood in London to mean small. I can state positively that the London Gas Companies are supplied almost exclusively with unscreened coal (north country), and that if it were run over a ¾-inch screen, 50 per cent., at least, would pass through, in the shape of nuts and small; and yet in the face of this fact gas engineers in the Metropolis scout the very idea of using either screened nuts or "rough small" (*i.e.*, nuts and small together, just as raised from the pit) or small *per se*.

Is there "any just cause" or reason why screened nuts (or even "rough small"), if well cleaned at the pit, and made from a first-class Durham coal, should not produce both good gas and coke? I cannot help thinking there *is* none, and that simple prejudice on the part of gas engineers shuts a cheap and useful article out of their retorts. Mr. Livesey deprecates the use of expensive cannel to raise the illuminating power of the gas made from ordinary Newcastle coal. Then why does he use it? Why not use cannel of a cheaper description, and distil it in separate retorts, so that the coke could be kept apart from his ordinary produce and burnt under the retorts?

It is within my knowledge that cannel coal of excellent quality can be delivered in London at 15s. per ton. This cannel will yield 10,000 cubic feet of (at least) 22-candle gas, and about 10 cwt. of coke. This coke, from its compactness, is probably not adapted for domestic purposes; but, owing to the comparatively small quantity of ash it contains, would be found perfectly suitable for firing the retorts or for the generation of steam. A coke containing something like 90 per cent. of carbon *must be of value*, and the remaining residual products will probably be found fully equal, if not superior to those obtained from Newcastle coal. I leave it to gas engineers to decide the relative value of the above-mentioned cannel compared with Newcastle coal or Boghead cannel.

I take the illuminating power of the latter at the standard fixed by Mr. Livesey—viz., 30 candles. I am not *certain* that the prices I name for Newcastle coal and Boghead are absolutely correct, but they are, I believe, near enough for the purpose of comparison. I therefore ask those who are practically engaged in the manufacture of gas from coal: What is the relative value of Newcastle coal, producing 10,000 cubic feet of 14-candle gas, and 12 or 13 cwt. of coke, taking the cost at 13s. per ton, compared with cannel costing 15s. per ton, which produces 10,000 cubic feet of 22-candle gas and 10 cwt. of coke, or Boghead cannel, costing, say, 34s. per ton, and yielding 11,000 cubic feet of 30-candle gas and a coke of very little value?

As to the question of distilling coal at a high as against a moderate rate of temperature, there is probably no higher authority in existence than Mr. Livesey himself, and I have no doubt he will be able to deal with it effectually.

INQUIRER.

London, Oct. 29, 1880.

THE ORIGIN OF CANNEL COAL.

SIR,—The origin of cannel coal seems to have been the subject of various theories and speculations. It has been supposed by some, for instance, that the formation of cannel has taken place where the mass of vegetation has been well macerated by water before its final submergence and solidification. The agency of heat, however, seems to account in the most rational manner for its formation.

It is now generally acknowledged to be a fact that the great majority of our coal seams have once existed in the form of dense growths of bog moss, ferns, and such like vegetation, which have accumulated for ages, after a similar manner to the peat met with in Ireland and other places; the only difference seeming to be that, in the "carboniferous period," this kind of vegetation grew with much greater luxuriance and rapidity than before or since. These vast masses of peat have been afterwards quietly submerged, and other deposits of various kinds of strata laid thereon. The pressure and heat which the bed or beds must undergo when sunk deep in the earth's crust, would, as is well known, be very great. The lighter and heavier hydrocarbons would in this case be partially set free; but, being unable to escape, these light-giving constituents would collect in greater abundance in the top than in the lower portions of the seam, and it is a remarkable fact well known to many that "tops" are more suited for making gas than "middles" or "bottoms."

In most coals a certain amount of the volatile constituents would be lost before the final solidification; and where but little was lost, there would the coal approach nearer to the quality described as cannel coal. The coal-bearing strata of Scotland, for instance, would be less likely to be permeable to the gases than the coal-bearing strata of England. Hence the greater abundance of cannel coal in the former may be accounted for.

That heat has been the agent in transforming the ordinary coal in some cases to anthracite, is well known; and instances have occurred (in cases where the coal has been in contact with volcanic rock) where it has been possible to trace the same seam of coal through the various stages of cinder, soot, and anthracite, to bituminous coal.

If the above theory be correct, it should be borne out by other facts, and probably some other readers of the JOURNAL, more practically acquainted with the conditions under which coal and cannel occur, will notice something either bearing out or militating against the theory.

B. ASKEW.

Northwich, Oct. 27, 1880.

UTILIZING THE WASTE HEAT OF RETORT-SETTINGS FOR THE GENERATION OF STEAM.

SIR,—I have perused with deep interest the paper by Mr. Jolliffe, of Sunderland, on "The Utilization of Waste Heat from Retort-Flues for the Generation of Steam," read before the recent meeting of the North of England Gas Managers Association. This has been my study for the last 20 years, and for some time past I have laid down plans for such experiments; but in provincial gas-works such experiments cannot be carried out without considerable cost, which one cannot always prevail upon directors to make. I have consulted a number of engineers and gas managers on the subject; but on all occasions grave doubts have been expressed: If I realized my object it would be at the sacrifice of my retorts, labour, and fuel.

Having to make extensions last year, a very good opportunity arose to give the long-cherished idea a practical trial. Obtaining permission

from my Gas Committee to fix two boilers, I consulted Messrs. Horsefield and Co., of Huddersfield, as to the best form and size for carrying out my views. We finally arranged for two cylindrical boilers to be constructed, 20 feet long by 6 feet in diameter, with two flues (2ft. 6in.) passing through each boiler, and both tubes intersected with three Galloway tubes. I took every possible care that the same were fitted with steam and water gauges, safety-valves, and also one of Hopkinson's blow-off alarm valves. Having my doubts as to realizing the object of my desire—the heat having to descend 10 feet from the retort flues to the bottom of the boiler—I arranged for the boiler to be fixed parallel to the main flues of the retort-beds, the heat first passing through the two centre tubes of the boiler, underneath the bottom, and along both sides and end; thence to the chimney.

All arrangements being complete, I diverted the heat, by dampers, from the retort flues; and, in the course of twelve hours, I had the gratification of seeing 40 lbs. pressure recorded on the steam-gauge. Being sure of success, I then turned on the steam-valve, which conducted the steam to the engines—150 feet distance from the boilers—through a 4-inch pipe, it being in November, when I had six furnaces at work. I then had doubts as summer approached. Knowing I should have only two furnaces at work, I thought I should have to fall back upon the firing of my second boiler, which I had previously fixed on the old system; but, to my utter astonishment, I found that steam could be maintained at 40 lbs. pressure, and I then had to draw the damper for the surplus heat to pass up the chimney.

This boiler has now been at work eleven months. The heats of the retorts have not failed at any time; and better and more regular heats are maintained without extra fuel. The steam thus generated works two engines for the exhausters, a mortar mill, the ammonia and tar pumps, a "pulsometer," a cinder riddle, and it forces water 60 feet high to a scrubber. All this has been accomplished without the cost of one penny.

The saving by the adoption of this method for generation of steam will be better understood by managers of gas-works than I can explain, if they consult Mr. Corbet Woodall's paper read before the parent Association in 1877, and referred to in Mr. Jolliffe's paper.

I believe a perfect method of utilizing waste heat is secured for the generation of steam. The principle is so simple that it can be introduced at the smallest or the largest gas-works, and must eventually revolutionize gas manufacturing when economy is considered.

FREDERICK BAILEY, Manager.

East Retford Corporation Gas-Works, Oct. 27, 1880.

HEAT OF COMBUSTION.

SIR,—The unit for the measurement of heat, described in your last issue, p. 644, is one of several which may have been chosen; but the heat developed by the combustion of diamond, &c., is not there stated in that unit, but in another one 1000 times greater. Expressed in the chosen unit, the heat developed by diamond is 94,800. Thus corrected, the statement is comparable with that of the approximate calorific power of anthracite—see p. 656—viz., for an equal weight, 60,000 units.

Oct. 30, 1880. ENOCH EVANS.

Legal Intelligence.

SALFORD HUNDRED QUARTER SESSIONS.—WEDNESDAY, OCT. 27.
(*Before Mr.* W. H. HIGGIN, Q.C.)

THE STRETFORD GAS COMPANY AND THEIR ACCOUNTS.

It will be remembered that this case was before the Court on the 6th and 7th ult. (see *ante*, page 567), judgment being postponed until this day.

Mr. TAYLOR again appeared for the petitioners; Mr. NASH represented the Company.

The CHAIRMAN, in delivering judgment, said the petition was presented to the Court in April last, and came up for trial at the last intermediate sessions, when the matter was fully gone into. The Court was composed of Mr. Christie and himself, and they had the advantage of the presence of Mr. J. A. Russell for a short time during the first day on which the matter was before the Court. When the arguments were concluded, it was decided that the absence of Mr. Christie when judgment was given should make no difference whatever. The petition was presented to the Court by certain consumers of the gas manufactured by the Stretford Gas Company, and was preferred under the 35th section of the Gas-Works Clauses Act, 1847, 10 Vict., cap. 15. The prayer of the petition was that a reduction might be ordered by the Court in the price of gas supplied by the Company. All that was possible to be said on both sides was, he thought, well said. It then became the duty of the Court to look into the Act of Parliament on which the petition was based. Before referring to one or two sections of the Act, it might be sufficient to state that the Company had an Act which provided that the capital should be £100,000. One section of the General Act provided that "the profits of the undertaking to be divided amongst the undertakers in any year shall not exceed the prescribed rate"—that was to say, the rate prescribed by any Act of Parliament authorizing the company to raise original, new, or additional capital—"or, where no rate is prescribed, they shall not exceed the rate of £10 in the £100 by the year on the paid-up capital in the undertaking, which in such case shall be deemed the prescribed rate, unless a larger dividend be at any time necessary to make up the deficiency of any previous dividend which shall have fallen short of the said yearly rate." The meaning of this section appeared to be that under no circumstances should a gas company divide more than 10 per cent. They knew that Parliament, when companies went for power to raise additional capital, usually limited the amount of the dividend to something less than 10 per cent.; and therefore he thought it might be taken, under all the circumstances, that 10 per cent. was the percentage to be paid. In case no percentage was fixed, this was the dividend. At Stretford he understood that some additional capital was entitled to a dividend of 10 per cent., and other capital to 7 and 7½ per cent., respectively; therefore in their case the maximum dividends were respectively 10, 7½, and 7 per cent. Beyond these dividends the Company did not appear, either by their own Act of Parliament or the Act to which he was referring, to have any power to divide amongst themselves a greater sum in the shape of dividends than 10 per cent. in one case, and 7½ and 7 per cent. in others. The Act of Parliament went on in the 31st section thus: "If the clear profits of the undertaking in any year amount to a larger sum than is sufficient, after making up the difficiency in the dividends of any previous year as aforesaid, to make a dividend at the prescribed rate, the excess beyond the sum necessary for such purpose shall from time to time be invested in Government or other securities." He took it that the obvious meaning of this was, that after paying the maximum interest, whether it was 10 per cent. or any other rate of percentage, whatever there was over should be invested in Government or other securities, the whole meaning of the Act being that, as between gas companies and their consumers, the gas company should not pocket out of their profits a larger sum than that which made up the maximum dividend. The Act went on: "And the dividends and interest arising from such securities shall also be invested in the same or like securities, in order that the same may accumulate at compound interest until the fund so formed amounts to the prescribed sum; or, if no sum be prescribed, a sum equal to one-tenth of the nominal capital of the undertakers, which sum shall form a reserve-fund to answer any deficiency which may at any time happen in the amount of divisible profits, or to meet any extraordinary claim or demand which may at any time arise against the undertakers." That was to say, suppose that in any one year less than 10 per cent., or less than the maximum dividend, was declared, next year the Company would have recourse to the reserve-fund in order to make up the difference between the amount of the dividend paid and the maximum dividend to which they were entitled. Again, in case of any emergency arising, it was necessary that the Company should have invested a reserved sum to which they could go—a sum of money necessary to enable them to carry on the works of the Company, so that the town or district should not be left in the dark—or, in other words, that the Company should have no excuse whatever for not being able to provide an adequate supply of gas by reason of the failure of funds. The section went on: "And if such fund be at any time reduced"—that was, if it be at any time reduced either by making up back dividends or by taking a sum of money from it for any urgent matter—"it may thereafter be again restored to the said sum"—that was the £10,000—"and so from time to time as often as such reduction shall happen." The 32nd section provided that "no sum of money shall be taken from the said fund for the purpose of meeting any extraordinary claim, unless it be first certified in England or Ireland by two Justices, and in Scotland by the Sheriff, that the sum so proposed to be taken is required for the purpose of meeting an extraordinary claim within the meaning of this or the special Act." That was to say, that before the Company should take away from the reserve-fund any portion of it for the purpose of such claim, the fact that the money was wanted for such a purpose should be certified by two Justices in England or Ireland, and in Scotland by the Sheriff; in other words, it was provided that the public should be protected from the reserve-fund being improperly reduced. The 33rd section said: "When such fund"—that was the reserve-fund—"shall, by accumulation or otherwise, amount to the prescribed sum, or one-tenth of the nominal capital of the Company, as the case may be, the interest and dividends thereon shall no longer be invested, but shall be applied to any of the general purposes of the undertaking to which the profits thereof are applicable." The reason of that section was perfectly obvious, and he need not refer further to it. The 34th section said: "If in any year the profits of the undertaking divisible amongst the undertakers shall not amount to the prescribed rate, such a sum may be taken from the reserve-fund as, with the actual divisible profits of such year, will enable the undertakers to make a dividend of the amount aforesaid, and so from time to time as often as the occasion shall require." In case they were not able to pay the maximum dividend in one year, they might in the next year have recourse to the reserve-fund. This brought him down to the 35th section, which read thus: "In England or Ireland the Court of Quarter Sessions, and in Scotland the Sheriff, may, on the petition of any two gas ratepayers"—and he understood that in this case the petitioners were gas ratepayers—"within the limits of the special Act, nominate and appoint some accountant or other competent person, not being a proprietor of any gas-works, to examine and ascertain, at the expense of the undertakers (the amount of such expense to be determined by the said Court or Sheriff), the actual state and condition of the concerns of the undertakers, and to make report thereof to the said Court at the then present or some following sessions." After the petition in this case was presented, the Court appointed an Accountant to make inquiry, and that officer made a report to the Court. The section went on to say: "And the said Court or Sheriff may examine any witnesses upon oath touching the truth of the said accounts and the matters therein referred to." Witnesses were examined on both sides. The section further said: "And if it therefore appear to the said Court or Sheriff that the profits of the undertakers for the preceding year have exceeded the prescribed rate, the undertakers shall, in case the whole of the said reserve-fund has been and then remains invested as aforesaid, and in case dividends to the amount hereinafter limited have been paid, make such a rateable reduction in the rate for gas to be furnished by them as in the judgment of the said Court or Sheriff shall be proper, but so as such rates, when reduced, shall ensure to the undertakers (regard being had to the amount of profit before received) a profit as near as may be to the prescribed rate." That was to say, that if the Court made any order to reduce the price of gas, it should not reduce it beyond such a limit as would, so far as that Court could order, prevent the company from paying the maximum dividends which by law the shareholders were entitled to. It was contended that upon the true construction of the section, and upon the finding of the accounts by the officer appointed by the Court, the Court had no jurisdiction to entertain the question at all, because there were two conditions precedent to the Court having jurisdiction, and inasmuch as the jurisdiction of the Court depended upon those two conditions being fulfilled, if one or both remained unfulfilled the Court had no jurisdiction. He had had considerable difficulty in bringing himself to view this section in the light in which both of his learned friends viewed it, but upon better and more mature consideration he had brought himself to the view entertained by Mr. Christie and Mr. Russell. Parliament had placed an obligation upon the Stretford Gas Company—in case they had power to do it—to found a reserve-fund. If they wilfully, negligently, or in any other way omitted to do that which the Act of Parliament imposed upon them as a duty, then in the construction of this section of the Act the Company must be assumed to have done that which Parliament said they ought to do, although it was a fact that they had not established a reserve-fund to the extent of one-tenth of their capital. They had had the power to do so, but had diverted the money which ought to have gone to the fund, and used it for their own private purposes. The Company, when objecting to the jurisdiction of the Court on the ground that the reserve-fund had not been formed, were thereby endeavouring to back up their own wrong by alleging a previous omission of duty. The consequence was that the Court must assume that the whole of the reserve-fund had been and now remained invested. The accounts of the Company had been examined by the officer appointed by the Court, and had also been examined by a gentleman on behalf of the Company, and from the evidence it might be taken that somewhere about £4000 remained in the hands of the Company. The question, therefore, now was whether the Company had had in their possession a sum of money amounting in the whole to £10,000. From the evidence of the officer of the Court—and his evidence was corroborated by a witness called on the part of the Company—it appeared that they not only had had £6000 in their possession, but more than that sum. The Company's own officer had given evidence showing that they had had

the means of complying with the Act of Parliament, and no reason had been offered as to why they had not done so. The accounts had been fully gone into, and the report presented upon them was very voluminous. This report showed that in addition to paying the maximum dividends which they were by law entitled to receive, the Company had appropriated the sum of £17,109 6s. 6d. If this was true, and the Company had £4000 invested, they had paid themselves £11,109 6s. 6d., which ought to have gone to a reduction in the price of gas, and which was money illegally taken from the pockets of the consumers and put into the pockets of the Shareholders of the Company. It was wholly immaterial whether the sum was £17,000, as reported to the Court by its own officer, or whether it was put down at £8000, which was the sum given by a witness called on behalf of the Company, because the same result arose, except that the sum which the Shareholders of the Company had divided among themselves, and put into their own pockets, was reduced to £8000. The Court had, under the circumstances, come to the conclusion that there ought to be a reduction in the price of gas; they had also come to the conclusion that in case the Company should have a desire to have that decision reviewed, they would give every facility for the purpose. An order that the price of gas should be reduced to 3s. 2d. per 1000 cubic feet would therefore be made.

Mr. TAYLOR said he should like to call the attention of the Court to the fact that there was no provision in the special Act for an appeal, and that there could be no case stated unless express power were given for it.

The CHAIRMAN observed that he was the only member present of the Court who heard the matter, and as they had considered the matter beforehand, he could not do anything which would prevent the Company from appealing if they chose to do so. There was also, he said, another reason why the Court were desirous of affording every facility for reviewing the decision, and this was the fact that the Company had put into their pockets the large sum of money which was mentioned in Mr. Aldred's report. It might very well be, although the Court had not the power to order it to be done, that there was a Court which had the power to compel the Company to refund that amount.

Mr. TAYLOR said he had only mentioned the matter in order that it might not be said hereafter that he did not call the attention of the Court to the subject. Moreover, the Company, in conducting these proceedings, were supported by the gas-rates—in reality their expenses with regard to the petition came out of the pockets of the gas consumers. They were, in fact, actually using the money of the petitioners to carry on an expensive litigation against the consumers, while the petitioners had to pay their own costs and those of the Company as well. He had, however, to ask for costs for the petitioners.

The CHAIRMAN: If you ask for costs they will be granted.

Mr. NASH: Not without hearing me, I hope.

The CHAIRMAN: No.

Mr. NASH contended that the Court had no power whatever to grant any costs beyond the costs of, and the remuneration to be given to Mr. Aldred, the Accountant. Where costs were granted it could only be by some express provision in the statute, and there was none in the 35th section.

Mr. TAYLOR said his friend was altogether in error, for the 35th and 36th sections provided that the nomination and appointment of the Accountant should be at the expense of the undertakers. Then there was subsequently to be a report to the Court and an examination of witnesses. If the petitioners had been wrong there was express power given in the 36th section to make them pay costs.

The CHAIRMAN: You ask for costs whatever may be the consequences?

Mr. TAYLOR: Yes, and we will take the consequences.

The CHAIRMAN: And you shall be given costs. I should say that in coming to the conclusion to give facilities for reviewing our decision, we were led by this consideration—that, as far as I know, this is the first case ever heard under the Act in this county.

Mr. TAYLOR: It is the only case under the Act reported anywhere.

The CHAIRMAN: There is another point, Mr. Nash, which I should like to mention. I cannot conceive that the Company will go on with the case, for there is another section in the Act of Parliament which applies to them, to which I direct your attention—that is the provision for the filing of accounts.

Mr. TAYLOR then asked that the costs should be taxed at Preston.

The CHAIRMAN: We will make an order that the costs shall be taxed at Preston. It was agreed that the judgment of the Court was to be delivered to-day, and in the absence of a member of the Court; and that no objection whatever should be taken to the decision on this account. Supposing that this is technically wrong, Mr. Taylor, you can present another petition, and then judgment will be delivered rightly. We make an order for the costs to be taxed at Preston.

Mr. TAYLOR: It was agreed that the costs should be taxed at Preston, but now they say that they will not consent, and that we may do our worst.

The CHAIRMAN: If the Company are so badly advised as to say they will do their worst, probably you (Mr. Taylor) may show them a plan of doing your worst, which may cause them to change their minds.

Later on in the afternoon Mr. Nash, who had gone out of court before Mr. Taylor made his statement with reference to the taxing of the costs, said that Mr. Taylor was under a misapprehension in the matter, for the Company would probably pay the costs in a generous and open-handed manner.

LAMBETH POLICE COURT.—FRIDAY, OCT. 29.

(*Before Mr.* HOSACK.)

ANOTHER OPPONENT OF THE CONSTANT SUPPLY SYSTEM.

William Snell, of Falmouth Road, Kent Road, a member of the Vestry of St. Mary's, Newington, and owner of house property in the district, appeared to a summons taken out by the Lambeth Water-Works Company for neglecting to comply with the regulations with regard to a constant supply of water to houses of which he is owner, in Ingoldthorpe Grove, Glengall Road.

Mr. BESLEY appeared in support of the summons, and said the defendant had been guilty of a breach of the regulations made in order to allow of householders receiving a pure and constant supply of water. This was more particularly desirable in thickly populated neighbourhoods. The Lambeth Water Company had used every endeavour to bring about, by degrees, this beneficial system; and the result of what had already been done was highly satisfactory. In order to effectually carry out the system of constant supply, it was necessary that owners of property should provide proper cisterns, fittings, &c., and in this respect the defendant had failed, notwithstanding proper notice had been given to him. The defendant was a Vestryman of St. Mary's, Newington, and as such it was thought that he should set a good example. In the section of the Company's district in which the defendant's property was situated, the owners of 7000 houses had notice in September, 1879, to put their fittings in such a state as to allow of a constant supply of water being furnished. Sixty days notice was given to do the work. In January last the water was turned on for the constant supply, when it was found that some 2000 houses were defective as to the fittings, thus causing a large amount of waste. Several cases of this kind had been decided against parties in this court, after which some 1600 houses were put unde proper regulations, and there remained only about 400 houses, the owners of which had not complied with the regulations. The defendant had been selected to be summoned particularly, as his position as a Vestryman should have induced him to obey the law. Owing to the defective state of the fittings of the defendant's houses, there had been a money loss to the Company of about £25, and he might add that if the tenants complained the defendant turned them out. Owing to the defendant not doing the necessary work, about 1000 gallons of water were wasted daily. After proceeding to point out the section of the Metropolis Water Act bearing upon the question, he asked that a penalty should be imposed to teach the defendant and the owners of property of a like description that they were bound to obey the law, and not go on in this way.

Mr. *H. J. Catmur*, head Waste Inspector to the Company, having given evidence,

Mr. HOSACK said he would grant the defendant 14 days grace, but warned him that if he did not by that time do the requisite work, the penalties, which were not very light, would be imposed.

Upon the application of Mr. Besley, his Worship allowed at present £1 1s. costs.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

THE SUGGESTED "STANDARD OF QUALITY," AND THE CONTAMINATION OF WATER IN CISTERNS.

In his last published report Lieut.-Col. Frank Bolton, the Official Water Examiner, has the following on the above-named subjects:—

"It is suggested that the question of a practical standard of quality should be considered and determined by the highest authorities connected with the medical and chemical professions, and when such standard is adopted by the Authorities it will then become the duty of Engineers connected with the Water Companies to work up to such standard, and the supply of water to the Metropolis would be regulated thereby. Thus the purely arbitrary terms, such as 'clear,' 'slightly turbid,' 'turbid,' and 'very turbid,' now used to describe the quality of water, would no longer be employed. These terms are objectionable, because that which one Examiner may consider 'very turbid,' another may deem only 'slightly turbid,' and *vice versâ*.

"Much of the water delivered for domestic purposes is constantly deteriorated, after leaving the Companies mains, by the dirty state of the cisterns on the premises of the consumers. Many of the cisterns, tanks, and butts for containing water, especially in small tenement-houses in the Metropolis, are in a disgusting and filthy state. All cisterns should be properly covered and be frequently cleaned out, and every care should be taken to prevent the contamination of the domestic supply after delivery. Now, as heretofore, it appears to be the rule, in building a certain class of houses, to place the cistern over the water-closet, with an untrapped waste-pipe communicating with the drains. These cisterns are often left open, and regularly receive the drippings from the roofs and gutters. They are, moreover, in close proximity to the dust-bins and other deposits of filth and garbage.

"The only remedy for this state of affairs will be found in the establishment of the constant supply system, and the consequent total abolition of these unfit receptacles. Meanwhile, and until the system of constant supply is completed, the owners and occupiers of houses are wrong in permitting such a condition of things to exist In the better class of houses and in many public buildings the cleansing of cisterns and tanks is frequently neglected for months, and, in some cases, years are permitted to pass without any examination or cleansing taking place.

"In courts and alleys several of the Water Companies are already giving constant supply by means of stand-pipes, provided, in most cases, with self-closing taps, and in the districts of those Companies which are extending the constant supply, a marked improvement has taken place in the quality of the water consumed by the small householder, which thus reaches the house in the same condition as it leaves the Company's mains.

"In these monthly reports attention is periodically drawn to the necessity which exists for the regular cleansing of cisterns, and also to the fact that the contamination of water from the gases generated by sewage is of far more frequent occurrence than is generally understood. Waste-pipes from cisterns are still to be found in direct communication with the sewers, and the gases thus flow back into the cisterns and become absorbed by the water. To prevent this the overflow-pipe should be brought outside the house, and the end left exposed to the air, instead of being carried into the drain, as is often the case. By the adoption of this plan the poisonous effluvia and gases from the drains will be got rid of These would otherwise ascend through the pipe, and not only be partly absorbed by the water in the cistern, but be mixed with the air in the houses, thereby becoming a cause of danger and disease."

THE LECTURES DELIVERED DURING THE GLASGOW GAS APPARATUS EXHIBITION.

During the continuance of the exhibition of gas apparatus, &c., recently held in Glasgow, the Committee of the Philosophical Society arranged for a series of lectures to be delivered on subjects of interest in connection with the display.

The first lecture was given on Friday, the 8th ult., when Mr. A. VERNON HARCOURT, M.A., F.R.S., Reader in Chemistry at Christ Church, Oxford, dealt with

DOMESTIC GAS LIGHTING.

The lecturer said that as this was the first of a series of lectures relating to the uses of coal gas and its bye-products, he should begin with a brief description of the manufacture of gas, illustrating his description by the aid of the model of a gas-works exhibited by Messrs. Laidlaw, Sons, and Caine.

Having followed the gas up to its distribution to private houses, he gave a description of the two forms of meter employed to register the amount of gas consumed. A beautiful specimen of a dry meter enclosed in a glass case, exhibited by Dr. G. Glover, was in operation upon the table. The lecturer explained the action of the valves by which the gas was admitted at a higher pressure to either side alternately of a moveable diaphragm, while it was expelled at a slightly lower pressure from the other side. By having this arrangement in duplicate on each side of a fixed partition, and so connecting the moving diaphragms and slide-valves that when the stroke on one side was completed, and needed to be reversed, that on the other side was in mid-course, gas was admitted alternately to a chamber on each side of the partition, and to every chamber in rotation. The volume of gas which passed through the meter during each movement of each diaphragm could be reckoned by multiplying the area of the diaphragm into the length of the stroke. For example, if the area of each diaphragm were to be 1 square foot, and their movement were 3 inches to and fro, a complete series of the four successive movements would be due to, and

would indicate, the passage of just 1 cubic foot of gas. The plate which formed the face of each diaphragm was supported by an arm attached to a vertical spindle, which was turned round through a small angle by each movement of the diaphragm, communicating its motion both to the slide-valves and also to a train of wheelwork, by which a record was kept of the number of the movements, thus showing the volume of gas passed through the meter.

The action of the wet meter was illustrated by some of these instruments with glass front and back, by a drum revolving in a glass water-tank, and a dissected drum provided by Mr. Foulis. It was pointed out that, as in the case of the dry meter, equal measures of gas entered each of four compartments in succession. Each compartment half overlapped its neighbours, and had two openings on opposite sides of the drum and on the same diameter. To one side of the drum a concave plate was attached, having a small central opening. The drum being more than half submerged in water, this opening was sealed, but a pipe which passed through it and turned upwards allowed gas to enter, the only outlet being into the compartments. The pressure of the gas against the side of the compartment which it entered being greater than that of the gas in the adjoining compartment from which gas was being expelled, caused the drum to rotate. As the drum rotated another inlet rose above the water, the compartment filled with gas sending the drum round till the diameter on which its openings lay was nearly horizontal, then both openings were sealed, and immediately afterwards the opening on the opposite side rose above the water, and through it the gas was expelled as the compartment was again submerged. At each rotation the meter transmitted a volume of gas equal to the capacity of that portion of the drum which was above the surface of the water. Thus the measurement depended upon the level of the water. Various methods had been devised for keeping this level constant, to some of which the lecturer referred. A most ingenious meter-wheel was being exhibited—an invention of Mr. Warner—in which an inner drum returned a portion of the gas from the outlet to the inlet, this portion increasing or diminishing with the change of water level, by the same amount by which the capacity of the principal wheel was increased or diminished.

The general action of a meter might perhaps be illustrated, Mr. Harcourt said, by comparing it to the turnstile by which visitors were admitted to the building, and which kept a record of the number who passed. Each compartment in turn was filled from one side and emptied on the other, no passage being possible without moving the turnstile round. All consumers of gas should understand that since only the passage of gas could make the meter move, and since it was easy to prevent the water rising above its proper level, the measurement of gas consumed was as little liable to error as the measurement or weighing of any article of domestic consumption. The mode of reading a meter was explained, and also the use of the cylinder which marked the passage of small quantities of gas, for observing consumption during a short period or for testing leakage.

From the meter gas should, the lecturer stated, pass to a governor for regulating its pressure. The construction of wet and dry governors for houses was explained by coloured diagrams. In both, any increase of tension at the outlet of the governor partially closed a valve by which the gas entered, and *vice versâ*. By a simple adjustment of weights the pressure was fixed at any desired amount, not exceeding the minimum pressure at which gas reached the governor. Provided the system of service-pipes within a house was sufficient for the number of burners, and the burners were good burners, the governor might be set so as to reduce the pressure to 5-10ths or 6-10ths of an inch of water. Each burner might then be adjusted once for all by any mode of obstruction, so that when the tap was turned fully on it should let pass that volume of gas which it consumed to most advantage.

Instead of regulating the pressure throughout a house by a single governor, Mr. Harcourt continued, it was also possible to prevent the waste of gas which occurred when it was consumed at too high a pressure, by having a regulator attached to each burner. Several burners were shown, devised by Mr. W. Sugg, Mr. D. Bruce Peebles, and others, the flames of which remained perfect when that of a burner without a regulator attached to the same pipe was destroyed by excessive pressure. Such regulators were of two kinds. In Mr. Sugg's governor-burner the construction was the same as that of dry governors on a larger scale. A constant volume of gas, the amount of which could be regulated at will, passed through an opening in the plate which formed the centre of the moveable diaphragm. An increased pressure beneath the diaphragm checked the inlet of gas. Thus the gas passed through an opening the size of which had been adjusted at a constant pressure; and its rate of passage was therefore constant. Of regulators of the other kind, Giroud's rheometer was the original type, of which Mr. Peebles's needle governor and another form exhibited by Mr. Sugg appeared to be good modifications. In these regulators also a constant flow of gas was maintained by causing the gas to pass through a fixed orifice at a constant pressure, but the constant pressure was maintained, not by checking the access of gas to the inlet side of the small opening, but by checking its escape, and thus increasing the pressure on the outlet side. The relation between the two might be thus stated: In both the gas flowed through a small opening from chamber A to chamber B. In the first type of regulator the difference of tension in the two chambers was maintained by checking the inflow into A, in the second by checking the outflow from B.

In respect of steadiness of flame, which, Mr. Harcourt said, was a matter of great importance, because unsteadiness constituted the chief objection which many people had to the use of gas, he remarked that many forms of gas-shades now largely in use were so defectively constructed that it was impossible for the flame to remain steady within them. Such globes or shades even increased the natural unsteadiness of the flame caused by the currents of air in the room. That was owing to the lower orifice of the globe being smaller than the width of the flame, in consequence of which the current of air passing up through the globe impinged upon the edges of the flame, and caused them to flutter. If, however, a globe with a wide orifice below—not less than 3½ or 4 inches in diameter—was used, the whole of the flame was in the current of air, while at the same time it was protected from the general movement of the atmosphere. These statements were illustrated by a couple of globes—one defective, and the other properly constructed. Speaking of ground and opal globes, the lecturer said it was a matter of opinion whether they improved the appearance of gaslight, but before deciding to adopt one or other of them, the consumer should recollect, in regard to ground globes, that he sacrificed 40 per cent. of the illuminating power of gas, and in the case of opal globes no less than 60 per cent.

From this point the lecturer proceeded to discuss some of the dangers likely to result from the use of gas. One danger was the inhalation of noxious fumes, and the other the risk of explosion. In reference to the former, Mr. Harcourt said that the purifying process to which gas was subjected at the place of manufacture should be sufficient to remove from it the sulphur which gave gas its injurious property. Most works were provided with apparatus for testing the purity of the gas, and if the apparatus were properly attended to no impure gas could be supplied. It so happened, however, that sometimes impure gas was furnished to consumers—impure in the sense of containing more than 6 or 7 grains of sulphur in 100 cubic feet of gas. Gas containing less sulphur than this amount was practically quite pure, and was, at all events, innocuous. The lecturer next proceeded to show by experiment how the presence of sulphur in gas could be detected. Dipping a piece of paper in a solution of acetate of lead, he held it over a tube containing pumice-stone coated with platinum, and through which a current of gas was passed. In a few seconds a dark stain was produced upon the paper, thus showing the presence of sulphur. He said, however, that this was a delicate test, and that it showed the Glasgow gas to be exceptionally pure. At Oxford, from which city he came, the paper would, in similar circumstances, be almost immediately covered with a very dark stain. With regard to the risk of explosion, the lecturer said that this might happen through the gas being turned on again in the act of turning it off, or from the absence of water in the tube of a gaselier, or through some leakage in the pipes caused by corrosion, or by a nail being driven through a pipe, or by injuries done by rats. The presence of an escape of gas could very soon be discovered, and, of course, it was the duty of the consumer to ascertain, if possible, where the escape came from. He was not now speaking of such escapes of gas as sometimes caused a slight smell of gas in a house, and he did not think any one would trouble himself about such an escape, for if it did not exceed one-sixth of a cubic foot per hour there was no risk of explosion, and he did not think it had ever been shown that such an escape was injurious to health. He was referring to those larger escapes which could not go on long in a house without causing considerable inconvenience. Of course, the readiest and most certain method of finding an escape of gas was by applying a light along the pipes, and generally such operation could be conducted without danger. Of course the gas engineer or householder who, experiencing a strong smell of gas, immediately took a naked light and endeavoured to find its origin, would be, to say the least, a rash man. Being lighter than air, gas always rose to the ceiling, and before bringing a light into use, the windows and doors should be thrown open in order to effect a clearance of any gas that might have accumulated. When this had been done there was no risk whatever in applying a naked light to the pipes, because there was no danger in a jet of gas itself, but only in the possibility of sufficient gas having escaped to form an explosive mixture with the atmosphere of the room. In order to illustrate the nature of a gas explosion, the lecturer showed a very interesting experiment. He inverted a glass jar over a burner. The jar, instead of having a closed bottom, was continued in a tube, which, of course, when the vessel was inverted, rose into the air. The gas having been turned on, the air in the jar soon formed with it an explosive mixture, and on applying a light to the end of the tube an explosion occurred. The flame rushed downwards, of course without doing any harm, but with sufficient force to show the nature of an explosion.

On Tuesday, the 12th ult., the second of the series of lectures was delivered by Mr. Greville Williams, F.R.S., his subject being

THE HISTORY OF COAL-TAR COLOURS.

As Mr. Williams's highly interesting and instructive lecture* before the British Association of Gas Managers, in June last, has been so recently published in these columns, there is little that need be said of the Glasgow one, except that it was in every way a marked success, and was very well received by a large audience. After tracing the development of the coal-tar colour industry to its present stage of development, and prophesying a great future for it, Mr. Williams concluded by saying that in ancient times the purple, which it was death to all below Imperial rank to wear, was only the juice of a poor shell-fish. It had been reserved for modern chemical science to show that every colour in the loveliest opal might be extracted from the foul and offensive refuse of gas-works; and queens and princesses owed their most brilliant adornments to the products derived from so lowly a source.

[The third lecture was one with which we have no special concern. It was delivered on Friday, the 15th ult., by Professor G. Chrystal, of Edinburgh, who discoursed on "The Electrical Transmission of Sound."]

On the 19th ult. Dr. Stevenson Macadam, of Edinburgh, delivered the fourth of the lectures, on

THE ILLUMINATION OF LIGHTHOUSES.

The subject of this lecture was, Dr. Macadam said, a matter which possessed for him considerable personal interest, and at the same time was of a great national importance. Up till about a century ago common coal or wood fire was pretty much the only representative of the lighthouse, and in their primitive condition the wonder was that lighthouses could be any guide to mariners going from port to port. There were records of important lighthouses at Alexandria, Boulogne, and Dover, and these were undoubtedly simply wood or coal fires. A century ago the question of the use of oil was barely considered. When the first Eddystone lighthouse was erected, the only things used there were a tallow candle or two, and even when Smeaton erected the last lighthouse on the rock a number of tallow candles were employed. The use of the candles was continued till the beginning of the present century, when oil did good service instead; and in carrying out improvements in lighthouses, there was no doubt, as far as regarded Britain, that the Eddystone Lighthouse, as constructed by Smeaton, was the first representative of what might be called the modern system of lighthouse illumination. Of course, the lamps used in lighthouses had been greatly improved in construction, producing much more brilliant lights than hitherto; but the introduction of mineral oils formed a very important epoch in the history of lighthouse illumination. The oil used was specially made for the purpose, and was what was generally called lighthouse oil, being of that degree of safety that, under all circumstances to which it was exposed in a lighthouse, it was practically non-explosive. Captain Doty's lamp—a paraffin one—was first used in a French lighthouse in 1868, and the late Emperor was so pleased with it that he ordered paraffin lamps to be used in all the smaller lights. After this order had been given, Captain Doty came to this country and submitted his lamp to the Northern Lighthouse Commissioners, and its introduction was ordered into one of their lighthouses, the Commissioners at the same time requesting that experiments should be made in regard to its efficiency, and as to how far paraffin oil could be used. It was found that double the lighting power was obtained from the mineral oil than from the colza oil, which had hitherto been used, and that at one-half the expense, so far as the purchase of the oil was concerned.

Dr. Macadam went on to refer to the different kinds of lights used in order to prevent one light clashing with another; and in this connection he alluded to an apparatus to be seen in the exhibition, constructed by Mr. Peebles, to bring out an idea of Sir W. Thomson's that every lighthouse could flash its own name; but said, with all due deference to so eminent a physicist as Sir W. Thomson, he (Dr. Macadam) was inclined to believe that the more simple method of registering a lighthouse was either by having two lights, the one above the other, or by flashing at

* Lecture on "The Past, Present, and Future of Coal Tar;" see Journal Vol. XXXV., p.

intervals of five or ten seconds. This mode of indicating a lighthouse was one which sufficiently satisfied the want of mariners, and at the same time did not perplex people.

Passing on, Dr. Macadam next spoke of the uses of reflectors and lenses, in which great improvement had been effected by the Engineers of the Northern Lighthouse Commissioners; and he also referred to the introduction of dipping lights, by which a beacon on an outstanding rock from a lighthouse might be illuminated without any light being actually on it, by simply throwing a reflected light on to it from the lighthouse.

In regard to the use of gas in lighthouses, the lecturer said that a large apparatus for its utilization was shown at the entrance to the hall; and wherever they could command gas in a large quantity he had no doubt the system was one which could be used with advantage. But at lighthouses where it would be requisite to prepare the gas for the purpose, it was quite clear that, independent altogether of the extra work and the extra men required, there were elements of uncertainty connected with its use which required to be considered. Already the labour connected with the lamps was sufficiently trying, and he was not inclined to think that where gas required to be prepared for the lighthouse itself, in the present state of knowledge, it ought to supersede the use of mineral oil.

In conclusion, Dr. Macadam said he thought he had noticed sufficient to show that, looking at the question as they now had it, they had the history of one of the most thoroughly applied branches of physical science. The labours of many men had dovetailed into each other, and developed step by step the lighthouse of the present day, with its high power of illumination, its splendid appliances for the conservation and utilization of the light rays, and also (what they should never forget) its highly trained and faithful body of attendants and keepers. These had all combined to give a certainty of result and, as far as they were concerned, never-failing security on their coasts.

The fifth lecture was arranged for Friday, the 22nd ult., when Mr. Thomas Fletcher, F.C.S., of Warrington, took for his subject

HEATING BY GAS.

He said that, unfortunately, he was not in a position to give the practical working values of the gas of high illuminating power as used in Scotland—his knowledge of it came from others; but from what he could learn it would appear to be about one-sixth worse as a fuel than the same quantity of London gas. This was not owing to its actual inferiority, but was caused simply by the greater difficulty in burning so as to obtain a compact flame of high temperature, such as was necessary for an economical gaseous fuel; and without setting up his opinion as absolutely reliable, in the absence of sufficient practical experience, he thought that as gas was now so largely used as a fuel, the Scotch gas companies would find it to their advantage to reduce their quality to the average English standard, reducing the price also in proportion. The fuel value of Scotch gas was very high, if any one could only succeed in getting hold of it, but the fact remained that the quick work and high temperatures obtained by furnaces and heating burners with gas of low illuminating power, could not be got with the gas used in Glasgow. Gas furnaces and burners made to do specified work in London or Birmingham were there total failures for the same purpose. An apparatus which would just melt cast iron in London would in Glasgow probably melt copper, but would certainly fail with cast iron, unless it had a very large margin power. At present the variation in the standard was like a break in the railway gauge, and caused endless trouble and annoyance to both makers and users of gas apparatus for heating purposes, checking most seriously the consumption of gas in Scotland, and doing considerable damage to the gas companies; the gas used for heating being almost entirely wanted when the gas-works were at present almost standing idle—*i.e.*, in the daytime, and in summer more than winter. The gas companies who did not seriously consider the advisability of taking every possible means to increase the consumption of gas for heating purposes were simply ignoring their most important business, and neglecting their most valuable and profitable customers. He would even go beyond this, and make for all purposes a gas of about 14-candle power as a maximum, and sell it, as it very well could, he said, be sold, at about 1s. 10d. per 1000 feet. This would be cheap, perfectly suited for all purposes, both lighting and heating, and would be very much more largely used than the present gas. If gas companies had any great future to look to, Mr. Fletcher said, it was from the use of gas for heating purposes, which could be cheaply made in large quantities at a time when the works were almost standing idle. Those who objected to the little additional heat given off from lighting burners could well afford the expense of ventilating, out of the reduction in their bills; and both makers and consumers would be benefited. If the Crystal Palace Gas Company understood their business, and he supposed they did, it was the business of a gas company to test and know all the cooking and heating appliances, to judge and select for their customers, knowing positively the best, and to fix the apparatus on hire, like meters, at a low rate, constantly publishing and distributing pamphlets explaining the advantages of gas heating and also its disadvantages, giving the whole case honestly and fairly. The united gas companies could well afford to offer a high premium for the best and most concise pamphlet on gas cooking, and to print and distribute it by millions. It was their duty to do so, and they would combine both duty and profit. It was not the business of any maker of gas cooking and heating apparatus, who naturally stated his own side of the case and overlooked all his weak points, even if he knew them.

In England a mixture of about 75 per cent. good coal and 25 per cent. cannel was, he said, commonly used for gas-making. This produced from each ton 13 cwt. of coke, 13 gallons of tar, 25 gallons of ammoniacal liquor, and 10,000 cubic feet of gas of about 18-candle power. The gas, if reduced to the solid state again, would weigh about 350 lbs. Allowing this as a fuel at a value of 1s. 2d. per cwt., which was about the average cost of the material used to produce it, the actual fuel value of coal gas was about 4½d. per 1000 cubic feet. At the gas-works its cost, delivered into the mains, including all expenses, was about 1s. 2d. per 1000 cubic feet.

Mr. Fletcher having dealt with the value of petroleum as fuel, said that gas and petroleum at present prices could never approach coal or coke as a competitor for large or continuous work, where the cheaper fuel could be burnt without great waste. When, however, he came to the cooking for private families, and almost the whole of the heating work required in small workshops, the conditions were completely altered, and gas fairly used became a very economical fuel. To have gas fuel at command was, he said, to be always master of the situation, as it was ready for instant use when the fires were out of condition or extinguished, and hardly a day passed when gas in both places would not be a cheap fuel for some purposes.

Mr. Fletcher said he was frequently asked, "Is gas a cheap fuel as compared with coal?" a question not easy to answer. For family cooking it was, he thought, rather cheaper than coal. In saving of work and time in cleaning and attention, it paid for itself in most cases ten times over. In the routine work of his own laboratory the absence of gas for odd work would entail an additional expense in wages of nearly 50 per cent., but in addition to this his special work could not be carried on at all without gaseous fuel. He referred to the production of some special alloys of the rarer metals which could only be produced with certainty under the most exact conditions of temperature and time. For cooking in ordinary families, for workshops where soldering, brazing, melting small quantities of metals in crucibles, &c., were required, and as an accessory in larger workshops, hotels, and public institutions, he considered gas fuel an absolute necessity for convenience and economy. It could not be approached by any other fuel known. At the same time it must not be forgotten that on account of its cost it would not do to waste it by using imperfect apparatus, and it paid better to throw away a faulty burner than to attempt to continue its use and make shift with it.

After speaking of gas fires, none of which that he had seen were at all effective, Mr. Fletcher went on to describe a cooking stove he had recently invented, and then treated of the heating of greenhouses. He said his tropical stove and orchid house was a very small one, too small to heat steadily with coke, and he had in it 40 feet of 4½-inch pipe heated by gas. The burner was placed in a boiler inside the house, but was lighted from the outside, and the flue ran inside the water-pipes for a distance of 20 feet. The products of combustion left the house over the lighting hole at a temperature of from 75° to 85°. To keep a minimum temperature of 60° in the summer and 50° in the winter cost about £10 per annum. To keep a minimum of 40° would cost about 25s. This was a further proof of the heavy cost of continuous work with gas; at the same time he could not do the same work with any other fuel, as the house was separate, and could not be heated from the other boiler, which was worked with coal, and which did ten times the work at a smaller cost. With gas it might be taken as an average that a rise of 1° in temperature cost about 1d. for 24 hours in a plant-house 12 feet square and 12 feet high.

[The lecturer concluded by showing some experiments in iron and nickel melting, as well as in cooking some few eatables before the audience.]

The sixth and concluding lecture of the series was delivered on Wednesday last, when Mr. J. N. Shoolbred, B.A., of London, spoke on the subject of "Lighting and Transmission of Power by Electricity."

MIDLAND ASSOCIATION OF GAS MANAGERS.

The Eleventh Quarterly Meeting of this Association was held at the Midland Hotel, Birmingham, on Friday, the 22nd ult. Mr. P. Simpson, of Rugby, the President, occupied the chair.

The Honorary Secretary (Mr. W. North, of Stourbridge) read the minutes of the last quarterly meeting, which were confirmed. He also read a minute of a resolution passed at a Committee meeting held at Rugby, with regard to the adoption of the proposal for the founding of a Birmingham medal for the encouragement of original research in gas-making. He stated that the amount promised to the medal-fund up to the present time was about £330, so that the proposal had been pretty successful, though it was hoped this would not prevent others giving.

New Members.

The names of the following new members, proposed at the Committee meeting, were read:—

Mr. W. Belton	Shrewsbury.
„ H. R. Coles	Halesowen.
„ J. R. Frith	Runcorn.
„ F. C. Humphrys	Ilkeston.
„ W. Littlewood	West Bromwich.
„ J. H. Parsons	Oswestry.
„ W. Stansfield	Drighlington.

The President proposed that the gentlemen whose names had been read should be admitted members of the Association.

Mr. C. Hunt (Birmingham) seconded the motion, and it was carried.

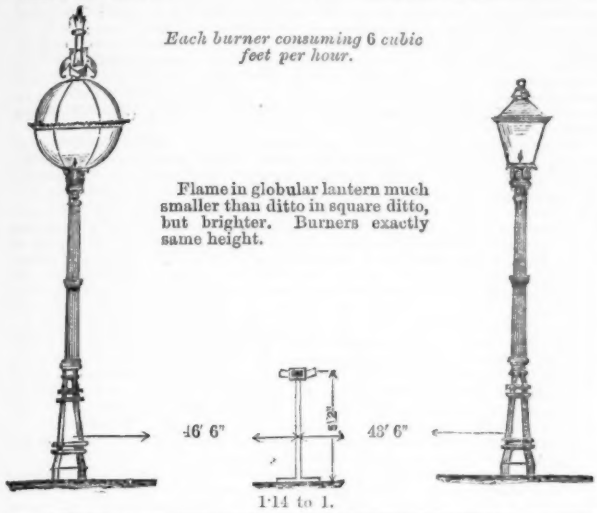
The Honorary Secretary (in reply to Mr. Hunt) said this made the number of members about 50.

Comparative Diffusive Powers of Square and Circular Lanterns.

Mr. Hunt, being called upon by the President for some remarks on the above subject, said: Mr. President and Gentlemen,—It will be recollected that, at the last meeting of this Association, when the subject of lamps and burners was under discussion, I stated that my opinion was the experiments then referred to showed that the diffusive power of circular lanterns was greater than that of lanterns with square panes. The experiments were not conclusive, but seemed to indicate that if the subject were pursued further, this would be found to be the case. I was asked, if opportunity served, to conduct one or two experiments in order to clear up the matter. In redemption of the promise I then made, I have now to bring before you the results of three very carefully conducted trials. Before sending round the diagrams [see accompanying engravings], I will state the arrangements for making the experiments. Test meters were, of course, put at the foot of each lamp-post, and these meters had special indices, so as to enable us to check off the consumption to the most minute degree. The lamp-posts were placed upon level ground, were precisely the same height, and as nearly as possible the flames were the same height also These latter were placed so as to face each other flat-ways. It is needless to say that the same quality of gas was used in both cases; and previous to the lanterns being put in position, samples of the glass were tested at the photometer-room, to ascertain if any difference existed in the power of transmission possessed by each. They were both found precisely the same—that is, the flame through each glass gave the same candle power. In the first test each burner consumed 6 feet of gas per hour. The flame from the globular lantern and the flame from the square lantern gave the same light at a distance from the circular lantern of 46 ft. 6 in., and from the square one of 43 ft. 6 in., giving an advantage in favour of the circular lantern of 3 feet. Squaring the figures, the difference was 1·14 to 1 in favour of the circular lantern. In this experiment it was observed that the flame in the globular lantern was much smaller than that in the square lantern, and apparently much brighter. In the second trial precisely the same lanterns were used, but the consumption of gas was rated to 10 feet per hour. The light was equal at a distance from the circular lantern of 41 feet, and from the square one at 34 feet. These distances squared give 1·45 to 1 in favour of the circular lantern. In the third experiment the same lanterns were used, but the consumption of gas was raised to 13·1 cubic feet per hour. The light was equal at a distance from the circular lantern of 47 ft. 6 in., and from the square one of 42 ft. 6 in., giving a difference in favour of the former of 5 feet. Again squaring the distances, the difference was 1·25 to 1 in favour of the circular lantern. All three experiments thus showed apparently that the circular lantern has the greatest power of diffusing light. I ought to add that the appearance of the flames in the globular lantern suggested, as a reason for the greater light obtained from them, that the air supply was under better regulation in that form of lantern than in the square

(No. 1.)

BRAY'S FLAT-FLAME BURNER in clear glass globular lantern. *v.* BRAY'S FLAT-FLAME BURNER in ordinary street lantern.



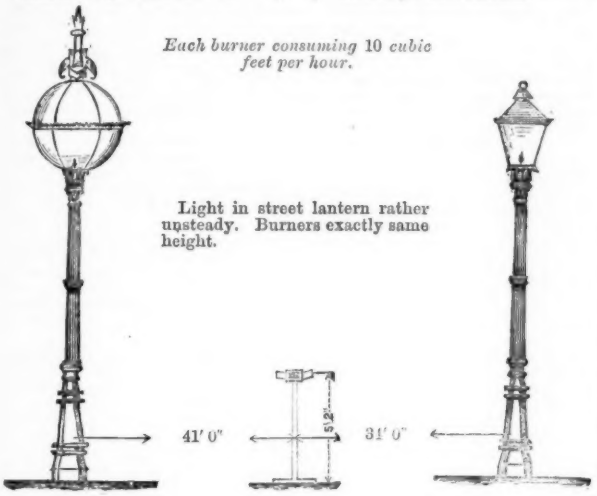
Each burner consuming 6 *cubic feet per hour.*

Flame in globular lantern much smaller than ditto in square ditto, but brighter. Burners exactly same height.

1·14 to 1.

(No. 2.)

BRAY'S FLAT-FLAME BURNER in clear glass globular lantern. *v.* BRAY'S FLAT-FLAME BURNER in ordinary street lantern.



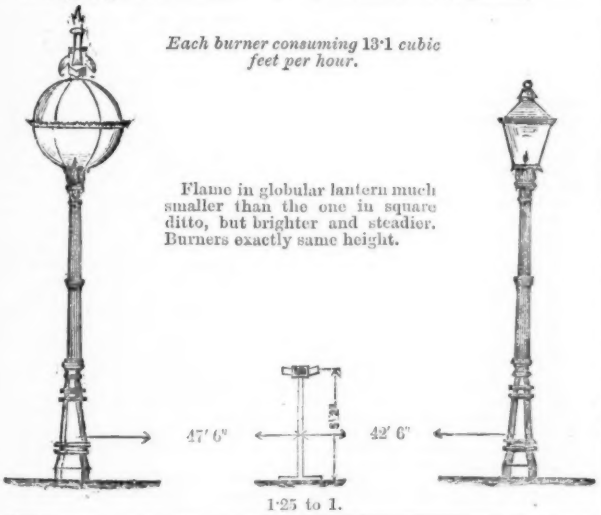
Each burner consuming 10 *cubic feet per hour.*

Light in street lantern rather unsteady. Burners exactly same height.

1·45 to 1.

(No. 3.)

BRAY'S FLAT-FLAME BURNER in clear glass globular lantern. *v.* BRAY'S FLAT-FLAME BURNER in ordinary street lantern.



Each burner consuming 13·1 *cubic feet per hour.*

Flame in globular lantern much smaller than the one in square ditto, but brighter and steadier. Burners exactly same height.

1·25 to 1.

Mr. W. T. TEW (Warwick) asked if Mr. Hunt had any other theory to account for the results.

Mr. HUNT: No; unless the rays of light were better directed to the angle of vision by the circular lantern. Passing through a square lantern they take a direction at right angles to the glass, and so they do in the circular lantern; but, as a matter of course, they are thrown in all directions by the latter, whereas in the square lantern they are thrown more in one direction, and that direction above the angle of vision.

Mr. T. COLLETT (Dudley): The circular lantern throws the rays more to the ground.

Mr. HUNT: The circular lantern appears to throw the light more where it is wanted.

Mr. J. S. CRANMER (Stratford-on-Avon): Were the experiments with lanterns having opal glass on the top, or plain?

Mr. HUNT: Perfectly plain.

Mr. CRANMER: Have you made any experiments with the opal glass?

Mr. HUNT: Exeriments with opal were reported at the last meeting, and some doubt was expressed that the experiments were not all on equal terms.

Mr. G. E. STEVENSON (Peterborough): I noticed in circular lanterns in London a great deal of reflection at the side. One could see the flame reflected from different points, and this would perhaps add to the light going in any one direction.

Mr. HUNT: That would affect the lantern all round. If light is reflected, it is prevented going in a certain direction.

The discussion then terminated.

[The subsequent proceedings included the reading of two papers by Mr. G. E. Stevenson and Mr. H. Woodall—on "The Manufacture of Sulphate of Ammonia," and "Meter-Rents," respectively. The revision of the remarks made by the various speakers in the discussions that followed, not having yet been completed, we are compelled to hold over till next week the remainder of the report of the meeting.]

WEST OF SCOTLAND ASSOCIATION OF GAS MANAGERS.

On the conclusion of the President's address, published last week,

Mr. D. C. NIVEN (Dunoon) read the following paper on

LEAKAGE.

I had the idea of considering the flow of Scotch gas at varying pressures, in pipes of different lengths and capacities; but the subject has so grown upon me that I do not feel myself prepared to treat it until I have further verified my data. The ground is, so far, untrodden by any Scotch manager, and a considerable amount of work is implied in the calculation of tables for daily reference.

As preliminary, I wish, on the present occasion, to make a few remarks on leakage. By it I mean the difference between the total quantity of gas made, as per station-meter, and what has been sold, used at works, and given as gratuities. The station-meter is thus the basis for leakage, and, consequently, a most important instrument. It has, however, no water-line tube, which may become an overflow into a waste-box. It has no float-valve that would determine a certain range of percentage fast and slow. It has, indeed, a glass gauge to show the line of water, and if the water exceed that line, there is, or should be, a syphon overflow; but if it does not, there is, at least in many meters, no automatic adjustment. Wherefore, if the meter has too much water, the registration of production will be at the expense of leakage; if too little water, the leakage will be at the expense of production. Again, if the temperature of the gas in passing through the meter be, say, 65° Fahr., and the gas on an average at the consumers meters, say, 50° Fahr., then there is a difference of volume of about 3 per cent.; but such a range of temperature would also cause a dilatation, through saturation of aqueous vapour, of about 1 per cent. To determine this point, a thermometer should be attached to every station-meter, not only as a means of reducing the registration daily to the standard volume, through Mr. Hartley's tables, but also as enabling an occasional comparison to be made of the average temperature of the gas, as supplied to consumers. Once more, coals vary in their hygrometric power, and accordingly the gases from some coals have a comparatively high percentage of aqueous vapour floating along with them; and this is independent of the saturation of a gas arising from temperature. Now it is obvious that if the holders or pipes be colder than the meter, then so much of this aqueous vapour in the gas will condense, and tend to fill the holders, drips, or syphons. We cannot in this case decide the percentage of loss unless the gas was analyzed immediately after leaving the meter, and then again at some distance from the works.

I sometimes read of a flattering cry about percentage of leakage; but that the phrase may have a meaning other than misleading, a few points must be considered. If I, for instance, have a loss now of 20 per cent., while the annual make is 10 millions, and the number of miles of pipage, say, 17, then there are 2 million feet of gas passing out of the joints of these mains, excluding in the meantime services and meters, or 13½ feet per hour in the mile; that is to say, 3 perforations each equal to about a No. 3 Bray's burner per hour in every mile of main-pipe. Now, if the production were doubled, the increased demand would act as a kind of exhaust in the pipes, and as the gaseous molecules would have a greater velocity, then shorter delay about these perforations would probably diminish the escapes. At all events, I cannot see that an increased production could so affect the perforations as to enlarge them. It would follow, then, that the main-pipe being in the same kind of condition, the leakage would be reduced to half of the former percentage. The manager, in this case, would most probably be called a clever fellow, while actually he had done nothing to deserve it. Now, so that justice may be done either to a former condition of the same works or in the comparison of one works with another, there must be a consideration of the doctrine of probability, by embracing all the possible occasions for waste, and that is not only every joint, but the kind of soil and the traffic upon it, as well as the annual make, and the distance from the works of the principal consumers. But if these elements are embraced in a proper judgment on leakage, then the ratio of loss to make, or the phrase "percentage," conveys no information as to the facts of the matter, and, in reality, becomes a delusion and a snare.

It has been held that in consequence of the osmotic force of gases a considerable leakage is the result. It is true that the fact of gaseous diffusion is clearly shown by respiration, ventilation, and the dilution of poisonous gases. It is no less shown by the wonderful uniform mixture of the atmosphere, as well as by that of coal gas. It has been proved that plaster of Paris, stucco, caoutchouc, and pressed plumbago give little obstruction to diffusion. It has been discovered that this osmotic force decreases as gaseous density increases, and that it acts not in mass but by molecules. Now, Professor Maxwell, in his work on "Heat," states that hydrogen and carbonic oxide can be made to pass through iron; and Dr. Frankland says that "the quality of hydrogen which is most important to us is its great diffusibility through porous substances, and more particularly through gas-pipes." But hydrogen forms from 30 to 50 per cent. of the volume of coal gas; wherefore the exosmoic law upon the molecules of hydrogen will decrease the gaseous volume, and thereby correspondingly increase the percentage of leakage. At the present day, however, most of the pipes of any size are cast vertically, which tends not only to uniformity of thickness, but also to increased density, and probably the leakage by exosmose in gas-pipes is inconsiderable. Mr. George Anderson says that he laid 700 yards of 14-inch main, and it stood under a 6-inch pressure, there being no escape. Mr. W. J. Warner, of South Shields, has also said that he laid 900 yards of 18-inch main, and it stood 24 hours under a 6-inch pressure, without the least indication of loss. Are these testimonies based upon their own personal experience, or are they the reports of some of their workmen? Seeing, therefore, that these experiments contradict scientific authorities, their conditions would

require to be known before being admitted into the region of fact. I freely state that Mr. Anderson and Mr. Warner are authorities in the gas world, but must be pardoned if I take to *avizandum* the question of whether such experimental facts have scientific significance.

There is a difference of opinion about the ratio of loss from mains. Some hold that the principal loss is from the services; others from the meters. As for myself, I can say that two-thirds of my loss was from the mains, and during the past five years I reduced the leakage 13 per cent. The joints were either badly set up or deficient in lead, and the pipes not firmly bedded. The services were carelessly connected, and not a few of their jointings had only a couple of threads in the junction of the pipes. Now in regard to a town having a heavy leakage account, what is the best mode of procedure in reducing it? One element must always be considered in giving the answer, and that is the least present expenditure, for doubtless directors are exceedingly loth to spend money on that which to them may not much affect the profits. I consequently on suitable days put on night pressure, and walked slowly over the whole length of main piping, and took notes of escapes; then, in surveying the meters of the consumers, I took special note of their line of services, and by this means I discovered the principal escapes, and repaired them *seriatim*. Afterwards I pierced over every joint of a section of any suspicious main, and by this means found out a few more bad joints. I then, in the case of some of the principal mains, cut them in two places, 220 yards apart, stopped the ends, affixed a test meter, and thus localized a few more escapes. In some cases, where the soil was open and porous, I had to strip the joints, as I was misled by the gas travelling along the piping sometimes 100 yards; in other cases, I have found it permeating the soil, and reaching a spot 50 yards from the place of exit in the main. While I consider, for all practical purposes, the foregoing mode of reducing leakage as being the cheapest, still the one most satisfactory and complete is that which divides the main-pipes into districts, then subdivides these into sections, and by means of a portable holder and test meter examines sectional pipes of, say, 220 yards, or one-eighth of a mile, in length, and then repairs them in the usual manner. I should, however, be opposed to cutting main-pipes for that purpose if they exceeded 6 inches in diameter, for bladders instead, or drips, could be made very effective as obstructive divisions. A nice size of holder would be 2 feet in diameter by 2 feet in depth, and, roughly speaking, having 6 feet capacity, and therefore could be arranged for 5 feet as testing with, say, 4 inches pressure, which would perhaps give a half more delivery per hour than the usual night pressure. The principal advantage of such a holder would be the heavy pressure on the main to be tested, and thus enable the escapes to be more easily discerned; but there would also be a great saving of gas, as the day pressure only would be on the rest of the mains not under examination. The next step I took was the gradual repair or destruction of the oldest meters, until they can now all appear at their work, and do it in an efficient manner.

There is a difference of opinion as to the merit of lead and turned and bored joints. Two kinds of turned and bored joints require notice. The one has the spigot turned, which corresponds to the whole-bored socket; the other has the spigot only half turned and a recess left for lead. In regard to the former, my experience is that they are a source of serious loss as well as annoyance, and there is evidently no cure for them but to cut off the turned spigot, and make lead joints. But this experience must be in concurrence with that of others, else the other kind of joint—the turned and bored—would not have been invented. In regard to this latter kind, I have no experience, but I would reason thus: Either the somewhat conical spigot is turned to correspond with the bored socket in a straight line, or at a particular angle of that line, and if such pipes be laid in deviation more or less from either, then there is more or less a liability to leakage. But gas-pipes are laid more or less in deviation from either a straight line or a particular angle of that line; therefore gas-pipes, if turned and bored, have more or less liability to leakage. Of course the reply is that this was foreseen, and hence the cavity for lead. But I would answer thus: Presuming that the turned and bored pipes are leaky, and the lead is used in the recess, is this a makeshift or a cure? It cannot be a cure, for their own argument—which is an *argumentum ad hominem*—is that different metals are differently affected by temperature, therefore the lead and iron being not uniformly affected are liable to leak. It follows then, as a corollary, that the leakage by means of lead cannot be properly cured. It is thus a makeshift, and this is the opinion, based upon experience, of not a few eminent gas engineers, who would gladly welcome all real improvements. But does not this argument also tell against lead joints? No; for those who advocate lead joints think there is more merit in the yarn than in the lead, and that the lead may be compared to the cap of a stuffing-box. Again, the turned and bored pipes fail where there is any subsidence of soil, as in mining districts, soft peaty soil, or vibrating ground from heavy traffic. They may perhaps pass if laid on solid ground or rock, in a straight line, and where no traffic of any consequence takes place. I hold, then, that they should be almost, if not altogether, discarded from gas-pipe laying. They may, however, be effective, and I think so in regard to water, for the drops of water are not to be compared to the molecules of gas, nor do the conditions of the laying of the pipes require to be the same.

In reference to lead joints, it is argued that as different metals are not uniformly affected by temperature in their expansibility, so lead joints cannot be trusted. But, besides containing a misconception of the lead joint, this is an assumption, for I am not inclined to admit that temperature in this country affects our pipes to such an extent even at their minimum depth of, say, 18 inches. It is also argued that the experience of not a few managers is that lead joints are unsound, and cannot be trusted. I could produce contrary testimony of the converse; but such a mode of reasoning is unfair, for it is virtually equivalent to two sub-contrary propositions. As for myself, I have lifted about half a mile of 4-inch piping that had been upwards of 20 years in the ground, and every joint was gas-tight. These joints had been made with tar-yarn and lead. The question here arises, Is there anything in the inherent nature of a yarn and lead joint that leads to the opinion of its unsoundness? Any other point of view would merely give rise to what is called the fallacy of accident. Hear what a practical man of some years experience says upon it. I refer to Mr. Whimster, of Perth, who, in a paper on "Main and Service Pipes," read before gas managers at Perth in 1865, says: "The spigot end of the pipe is placed within the socket of another, and the annular space between is filled to about half its depth—say 2 inches—with tarred gasket caulked firmly in. The outer half is filled with soft lead and caulked until it is perfectly gas-tight. This joint, when well made and at a sufficient depth in the ground to be safe from violent disturbance, is all that can be desired." The opinion here expressed about the soundness of lead joints is firm and clear, but the description of how to make such joints is most disappointing. He takes the trouble to explain what is a main-pipe, which everybody knows, but in regard to such an important matter as the making of a good lead joint there is meagre information. What, then, are the elements of a good lead joint? The spigot must be uniform in the socket; the yarn must be the best spun hemp, tarred or untarred, and well caulked, say to a half or two-thirds full of the socket; the lead must be soft, and free from tin and zinc, and there must be sufficient of it in the ladle to make a full joint at one running, otherwise there would be rings of lead; the clay belt or metal clasp should be so made that after the lead is run in there is a projection or bead of ¼-inch of lead over the face of the socket; and in caulking, a chisel and three sets of staving tools will complete the joint, which for finish and soundness is not to be surpassed. Relative to the attaching of services to mains there should be no chipping or gouging of holes; they should be drilled, rymered, and tapped. The wrought-iron pipes should have their couplings taken off and white leaded, and the ends of the lengths of piping should meet when the coupling has made a proper junction. In every case of a long thread there should be two hempen washers and two back-nuts.

A grave mistake is sometimes made by connecting a ¾-inch service-pipe with a 2-inch main. In some cases I have found at the junction in the pipe a crack which incurred a serious loss. It is plain that a 1-inch hole on the surface of a 2-inch pipe is relatively far too large, independent of the idea of the risk of fracture. I am much surprised at Mr. Whimster advocating ¾-inch lead services, putting forth even the idea of comparison with ¾-inch cast-iron and wrought-iron pipes. Why, ¾-inch cast-iron pipes are only about 4½ feet in length, which implies multiplicity of joints, and are so brittle that if let fall they will break like a pipe-shank. His experience should have dictated to him the folly of such a pipe altogether, instead of making a comparison as if it could in any way be commendable. Again, in looking over a price list issued from Glasgow, I observe that while 1-inch cast-iron pipe costs 11¾d. per yard, 1¼-inch is only 11d. The larger pipe is actually cheaper, and it is of far more use. My doctrine, based upon experience, is that services of ¾-inch or 1-inch should be of wrought iron, not cast iron, and that cast iron should not be less than 1¼-inch. The faucet of such a pipe will make a good joint with the piece of wrought iron required to complete the service to the soft pipe. While lead may, for aught I know, be trusted as a good service, still I am sure every one will admit that tin and composition pipes are altogether unsuitable to be below ground, or even to be below the flooring in case of accidents, exclusive of the idea of waste. I am happy in being able on this point to quote Mr. Newbigging, who, in his "Gas Manager's Handbook," condemns 2-inch cast-iron pipes as mains, and ¾-inch wrought-iron pipes as services, for they directly and indirectly tend to a heavy leakage account. It may be argued, however, that wrought iron, by its non-durability, is a great source of loss; but this statement is only a phase of the question of characteristics of soil for pipes. Doubtless for the soil to be gravelly, sandy, or boggy, it is very deteriorating, and it is even worse if the bed of the pipes be ashes, blast-furnace slag, or the refuse of chemical works percolating the ground. Under such circumstances the pipes would require to be coated with tar or pitch, and even bedded in earthy soil or clay. Malleable piping, if not coated with tar or pitch, is said to have its oxidation delayed by galvanizing its surface, or painting it with oxide of iron.

I do not think much loss can be attributed to meters. At the present time their construction is almost perfect, and consequently the great range of percentage, fast or slow, belongs to meters of a bygone day. It is certainly necessary that there be a periodical inspection, not only to keep the water-line all right, in the case of wet meters, but also in the event of stoppage occurring, that it be rectified without delay. It is found that dry meters under two lights cannot be trusted for correct registration. From this size, however, they do duty very well, and independent of their use at extremes of temperature, or for badly arranged internal fittings, they have been a good friend to the manager when the fraudulent consumer played his pranks with the wet meter. If any meter makes a revolution of its dial between one survey and another, it should be changed at once as being too small.

I believe that public lamps have often been the source of considerable loss. They have also been the occasion of much bitter feeling. If the hours be not strictly attended to, and the same kinds of burners used as were agreed upon, the stopcocks not carefully shut off during the day, nor the leaks about their tubes promptly repaired, then the lamps tell a tale in the leakage account. If in the case of average meter indication the burners of the meter lamps are not allowed to be changed like the non-meter ones, or if there be an obstruction in the tube, it must not be touched; or if the meter registers slow, or not at all, it is not to be changed; and if there be not a regulator to every lamp, then I consider such a system, under whatever name, as a kind of humbug, for there are no data as a basis to arrive at the consumption of the non-meter lamps. Where such kind of work is carried on, perhaps the better way is to charge for each lamp with a specified burner having a regulator, and for so many hours in the season.

The last point to touch upon is that of pressure. It is admitted by all that high pressure is a great contributor to the leakage account; hence the advantage of governors at works, and also street governors in hilly districts. It is also important, for the equalizing of the pressure and circulation of the gas, that the pipes of cross streets should be connected with the principal mains. I can realize the enormous loss through maximum pressure during the day on at least the half of my piping, by supplying a holder some miles out of the town. We are now relieved of this incubus, and the loss from it will be determined by next year. The line of pipes being too small, I have occasionally found three miles from the works a couple of pailfuls of pure tar in one of the drips. I have always understood that this tar was just the liquefying of the volatile hydrocarbons through high pressure and small pipage. From this fact one would almost infer that the quality of the gas was much inferior than when it left the works, but there was little difference in it. Might one, then, not rather infer that as the hydrocarbons had been deposited, the hydrogen and carbonic oxide had, to a considerable extent, transpired through the gas-pipes? This hypothesis would go far to explain a limited delivery, which was the fact. It is obvious that different towns vary in their day pressure according to circumstances of consumers and consumption, and hence one town cannot be a guide to another in that matter. If the initial night pressure be high through small piping, then will the quantity and quality of the gas be thereby seriously affected, and the remedy of laying larger pipes would soon recoup itself. If, on the other hand, the pressure be high through a greater supply than demand, then the one in charge requires to be taught the doctrine, and to realize it, that according to the demand for gas in the course of the evening, so should the supply be regulated.

To recapitulate, in the treatment of the subject of leakage I have endeavoured to point out its sources, preventions, and cures, and think the following propositions, as corollaries, highly probable:—

1. That the phrase "percentage of leakage" is a delusion.
2. That it is difficult to give a correct statement about actual waste of gas.
3. That it is difficult to compare one works with another regarding leakage, for, generally speaking, the circumstances of each are peculiar to itself.
4. That gas managers generally are dependent more upon their good fortune than their faculties for a small leakage account.

The question may be raised, in conclusion, What is a reasonable amount of leakage? Mr. T. H. Methven held 12 feet per mile per hour reason-

able; but Mr. W. J. Warner, in a paper read before the British Association of Gas Managers in 1873 (see JOURNAL, Vol. XXII., p. 590) says that "the unaccounted-for gas may be reduced to so small a minimum as to be lost in condensation." To understand this startling assertion, let us try to discover its meaning. What, then, is condensation? Either Mr. Warner means greater density, and thus less volume; or the liquefying of the gas, and thus less volume. But greater density in gas-pipes can only arise from difference of temperature, or pressure, or small pipage, or all together. Now, the small pipage may be enlarged, and while the temperature may be greater at the works than at the consumers meters, still the higher pressure at which gas is measured at the works may more than counterbalance either pressure lost through friction or decreased temperature of the gas on its way to consumers. Wherefore gas may be supplied without any loss or leakage whatsoever. Is this conclusion atramentaceous? Then let us try the other meaning—viz., the liquefying of the gas, and thus causing less volume. Of course we understand that the liquefying process takes place after the gas is measured at the station-meter. Now the diluents hydrogen, marsh gas, and carbonic oxide are not liquefied, neither is the illuminant ethylene (olefiant gas); it can only be the volatile hydrocarbons and aqueous vapour. But it is found, as a matter of experience, a routine fact in well-managed works, where there is no heavy pressure nor too small pipage, that these volatile hydrocarbons, &c., are carried to the consumers; therefore, in well-managed works, there may be no liquefying or condensation of the gas, and thus no deficiency in volume. Wherefore gas may be supplied without any loss or leakage whatsoever. Is this conclusion partaking of the nature of a *reductio ad absurdum?* If so, may there not be still another meaning—viz., that when the volatile hydrocarbons are deposited, the hydrogen and carbonic oxide escape by exosmose? If this be the meaning, then to speak of being "reduced to condensation," is only stating part of a fact, which, unless fully expressed, has no significance.

I think it is now plain that the subject of leakage gives rise to many difficult and thorny questions, but the latest attempt to brush them all aside has been made by an important and highly respected personage, who states "that we quite agree that the gas sold per ton of coal carbonized is the crucial test of successful management." Now, I would not dare say even what I intend saying, were it not that I am confident of having right on my side. That I may raise no man of straw, what is the meaning here? Coal is evidently taken as a species without the least consideration of the variation in the species. It is obvious that different kinds of coal have different productive powers, and that consequently, unless there be known the ratio of gas sold to gas made, we are completely in the dark. For instance, a coal gives in practical working 10,500 feet of gas per ton, and there are sold of it 9500 feet, which leaves a difference of 9½ per cent. Another coal gives 9000 feet per ton, and there are sold of it 8300 feet, leaving a difference of, say, 8 per cent. Yet in the one case there were sold 9500 feet, and in the other and better case only 8300 feet, or a difference of 1200 feet per ton, and possibly the last was considerably cheaper per 1000 feet. To speak of the quantity sold per ton without taking into consideration the gas made, is to me a most strange proceeding; but if it be said that, whatever sense the words may convey, there was no idea of considering the gas sold irrespective of the gas made per ton, then, after all, the old question of leakage in its many forms starts like a ghost into view.

One word more. Each manager knows the weak parts of his apparatus for manufacture and distribution, and it is his duty, either at once or gradually, according to circumstances, to apply the proper remedies.

Discussion.

The PRESIDENT, in inviting discussion on the above paper, said it was on a subject about which many persons felt keenly, and on which adverse opinions prevailed.

Mr. R. MITCHELL (Coatbridge) said that Mr. Niven, in his opening remarks, did not give due prominence to the law of exosmosis. This he (Mr. Mitchell) thought was a point upon which few men of lengthened experience had any doubt. He did not mean to bring his own experience to bear on the question, but he might say that he had examined some very old mains in the Coatbridge district, and found so much did exosmosis prevail, that he could light the gas which was passing through the pores of the metal; besides, the metal was greatly reduced. Gas had decidedly a very great influence upon metal, and he did not consider that the test referred to by Mr. Niven, 24 hours after a main had been laid, was sufficient. It was not a proper trial on which any gas engineer should give his opinion as to the law of exosmosis. He (Mr. Mitchell) thought that Mr. Niven would have touched upon the difference of temperature in gas at the works and at the point of ignition. He considered that this was one of the most serious causes of the loss of gas, for he knew some gas-works in which the gas was passed through the station-meter at temperatures ranging from 70° to 80° in winter, and before it reached the consumers it was 30°, the difference amounting to about 7½ per cent. of the volume. This formed an important part of the loss which was complained of in certain districts. Further, as to the quantity of gas being regulated to the supply to the town, he might say that in every works where there was a good station governor, this governor should regulate the quantity of gas according to the requirements of the town. Of course, if there were 15-10ths pressure on, that pressure would remain though there were only half-a-dozen lights in use. Then as to the jointing of pipes he had had considerable experience, and was of opinion that turned and bored joints were of no use in places where underground workings existed. If a lead joint was used, the joint gave a little, but the turned and bored joint snapped, and the consequence was an escape. When it was remembered that a hole one-tenth of an inch in diameter, with a pressure at 5-10ths, allowed an escape of 42 cubic feet of gas per hour, the meeting would understand what a loss must accrue in a mining district if turned and bored joints were used and gave way.

Mr. S. DALZIEL (Kilmarnock) said, with reference to the testing of pipes, he did not put much confidence in the test referred to by Mr. Niven, for the reason that he had put gas into sound lead pipes, and had found that within 24 hours little or no gas was left. In a house well fitted in every respect with pipes, say that the gas was turned off in the morning, in 24 hours afterwards it would be found, on proceeding to light it, that a blue flame preceded the luminous flame. This could only be explained by endosmosis—by air passing inwards through the pipes. He might say also that he had filled a glass tube with gas, and after three months it had all evaporated. A serious source of leakage was to be found in the service-pipes. He had come across two instances of this. Recently he relaid the mains in a whole street, and found only one fracture; but the service-pipes were in a deplorable condition, and yet in the street there was not a single complaint from an inhabitant. After the street was relaid he found a considerable difference in his holder—as much as a sheet of gas in a 50-feet holder. He could not have believed that there would have been so much difference if he had not proved it in this way. With regard to the turned and bored joints he had had some experience. On the advice of certain gas engineers, he tried these joints, and could assert that they were a source of annoyance until he leaded them all. The pipes were laid partly on a hill; there were a few curves, but not very great, and some heavy traffic passed along the road. The pipes had not been long laid when three or four, in a distance of some 400 yards, split at the faucets, in consequence of the traffic. Another important thing Mr. Niven had overlooked was the pressure there was during the daytime. This played an important part in the leakage account, and the pressure at which some managers had to work during the day told very heavily against them. In some works the pressure was 4-10ths or 5-10ths during the day, while in other works, on account of their position, the manager had to put on a pressure of from 1¼ to 1½ inches in one part of the town, and have only 4-10ths or 5-10ths at another part. Last year he reduced the pressure at which the gas was supplied in Kilmarnock, and sold 400 feet more gas per ton of coal carbonized, and was satisfied that, if he could work with 5-10ths or 6-10ths of pressure, he could sell from 400 to 600 feet more gas per ton of coal carbonized. This was a fact which was not very well understood, and he thought it ought to be more thoroughly investigated. If the pressure were doubled, one-half more gas would be sold, and if the pressure were reduced there would be one-half less leakage. If one town were to be compared with another, it would be found that the man who had the highest leakage account was the best man, because it might be that, owing to the position of his works, he had to give a heavier pressure, and this heavier pressure told upon his account. In his own works, for one part of the place he worked with a pressure of 13-10ths, and in the lower parts of the town the pressure was 4-10ths; but he knew that if he had to provide for a more level district he could effect a material saving in gas.

Mr. J. M'GILCHRIST (Dumbarton) thought the term "humbug," which had now become famous, was misapplied when Mr. Niven spoke of the average meter system. There was no system in existence at the present time that gave more satisfactory results. For many years there never was any satisfaction in London as to the quantity of gas consumed in the public lamps, even with the governors that Mr. Niven referred to, and it was only when the average meter system was brought into operation that complaints were removed. He (Mr. M'Gilchrist) thought the system should recommend itself to gas corporations. In different altitudes of a town there must of necessity be variations in the pressure, and if a meter was placed at intervals of a dozen or two dozen lamps in a particular altitude, and with the exercise of a little supervision over the lamp-lighters to see that they lighted the metered lamps properly, an accurate approximate measurement of the gas consumed could be obtained. That was the system adopted in Dumbarton, and it gave very great satisfaction. Mr. Mitchell remarked that turned and bored joints were quite unsuitable where there were underground workings; but there was no doubt that the half-turned and bored joint was the best that had yet been introduced. He (Mr. M'Gilchrist) had known of long lengths of mains being laid with these joints, and there had been absolutely no leakage from them. As to Mr. Dalziel's remarks about pressure upon the mains, he thought he made out a very bad case for himself, because he said that in the low-lying parts of the town there was only 4-10ths of pressure. It was well known that leakage was proportionate to the amount of pressure on the mains; and also that for about three-quarters of the year full pressure was not required, so that as the mains in Kilmarnock lay at a low level, the Manager there had the advantage. A gas-works on the top of a hill, as at Kilmarnock, must be more favourably situated, so far as leakage was concerned, than works at the foot of a hill.

Mr. NAPIER (Crieff) said he could corroborate Mr. M'Gilchrist so far. The best part of the town where he lived stood very high, and he could assure Mr. Dalziel that at the lower half of the town the pressure was only about 5-10ths, while in the upper district, if the mains were tapped, the gas would issue with such pressure as almost to blow one's hat off. The pressure had been found at these points to be about 3½ inches. If he had heard Mr. Niven aright, he (Mr. Niven) thought 18 inches of earth sufficient to cover the mains. Now all his (Mr. Napier's) mains happened to have about 18 inches of covering, and a good many of them were turned and bored joints, and he had had occasion to cut out many of the joints solely, as he thought, through there not being a sufficient covering of earth. He was now giving them 30 inches of cover, and thought that in most cases this was the remedy for faulty turned and bored joints. As to Mr. Mitchell's remarks in reference to old mains, he might say that about 10 years ago he took up some mains that had been in the ground for about 36 years, and very few of them seemed to be at all corroded.

Mr. M'GILCHRIST remarked that he did not think the corrosion was due to the gas. Perhaps it was owing to the quantity of cinders that had been used in making the roads in the district.

Mr. MITCHELL said about 15 months previously he took up 1200 yards of 5-inch pipe, and there was not 3 feet of it that could not have been cut with a knife, and the gas found its way quite easily through the sides. The whole of the surrounding soil was black in consequence of the gas passing through the pipe. Whether it was the action of the soil upon the pipe, or the action of the gas upon the pipe, he could hardly determine; but he attributed the condition of the pipe to exosmosis.

Mr. M'GILCHRIST said that in Dumbarton there were many places where the pipes had been in the ground for more than 36 years, and he even knew places where they had been laid for 50 years, and except that they were a little rusty, they were in perfectly good condition. He knew that in Bo'ness pipes had been taken up in exactly the same state as Mr. Mitchell had described. This, he thought, was conclusive evidence that it was not the gas which was at fault, but the soil in which the pipes were embedded, because if the corrosion was due to exosmosis, the law ought to hold as good in the one case as in the other.

Mr. BROWN asked whether it might not be attributed to the quality of the iron.

Mr. JOHNSTON (Hamilton) said he could bear out Mr. Mitchell's remarks as to the condition in which pipes were found on being taken up. He remembered lifting some pipes in Castle Street, Hamilton, and they were so eaten away that they could have been "whittled away" with a knife. He called Mr. Mitchell's attention to the pipes at the time, and they both came to the conclusion that the corrosion was due to the action of the gas. It could not have been due to the presence of cinders in the soil, because no such thing could be found in the street mentioned.

Mr. SINCLAIR (Rothesay) remarked that 21 months previously he took up a number of 5-inch pipes. These he had cleaned, and if they were only coated, they might be sold as new, as there was no loss of weight or difference in appearance. With regard to turned and bored joints, he had made many of them, and there had been only some two or three burst sockets, occasioned by the carelessness of the men in ramming the pipes home. He knew this because tests were made every night, and in all cases it was the last joint made that burst.

Mr. MARTIN (Kilmalcolm) said within the past few weeks he had seen pipes taken up that had been in the ground for 30 years, and the metal was perfectly good. The soil, so far as he could judge, appeared to have been eating into the pipes from the outside; but the gas did not seem to have had any injurious effect upon the metal. Within the last six years he had laid seven or eight miles of pipes with turned and bored and lead joints, and had also used half-turned and bored, with a cavity for lead, and this latter was, he believed, the best joint of the whole. He

thought if pipes were laid in ground largely composed of engine ash, one might be prepared for the metal crumbling away after a time.

Mr. NAPIER said his experience in reference to malleable and cast iron pipes was this: He had at Crieff several cast-iron services which were as good as on the day they were laid down; but 15 years seemed to be about the outside for a malleable iron pipe to last. Such pipes become very brittle. In his district the soil was, as a rule, gravelly.

Mr. RENFREW (Langbank) said he had 2½ inches of pressure at his works, and 12-10ths in the village. With a pressure of 1 inch at the works he could scarcely get a supply of gas in the village, and yet there would be something like 3 or 3½ inches of pressure at some of the high places. His mains were 4-inch where they left the works.

Mr. NIVEN, in reply, said that in the discussion of his paper the law of exosmose, or the passage of gases through metal pipes, had apparently been principally considered. He could not but agree with the remarks which had been made, but he qualified his concurrence in them by saying that, in so far as gas-pipes were concerned, exosmose could be passed as not of much moment. He had brought, as proof, the testimony of Mr. W. J. Warner and Mr. G. Anderson; Mr. T. Hawksley also held the same opinion. But independently of this, some persons considered that where there was heavy pressure there was, to a certain extent, a separation of the carbon and hydrogen molecules in the gas, and the hydrogen made its way through the metal of the pipes, and left the carbon, and thus the illuminating power of the gas, at a certain distance from the works, was more or less deteriorated. However, in so far as proof was concerned, the cases Mr. Mitchell quoted simply showed that his pipes were in a bad condition. He (Mr. Niven) did not speak of gas passing through decayed pipes, or pipes in an abnormal condition; and gas passing through such pipes did not, in his opinion, afford any illustration of the law of exosmose, but rather of the bad condition of the pipes. The law in question was only illustrated with gases left entirely to their own elasticity, without being under any initial or outside pressure. The condition of the pipes referred to arose either from the nature of the gas, the nature of the material from which the pipes were made, or the nature of the soil. If it arose from the nature of the gas, then, as gas was somewhat similar throughout the length and breadth of Scotland, there must be, not only in Hamilton and Coatbridge, but elsewhere, similar conditions of piping, and yet pipes which had lain as long in the ground as in the two towns he had mentioned did not show any such abnormal condition. This proved that it was not the gas which was at fault. Then the two remaining alternatives were the nature of the material from which the pipes were made, and the nature of the soil. Between these two he could not decide. He was inclined to believe that it was the soil. He could not think it was the pipes, for this reason: Cast iron had a certain percentage of carbon in it, and unless that percentage was considerably increased, and the carbon underwent some chemical change through contact with the iron, so as to soften the iron, he could not see that this had anything to do with the decay. But perhaps this cause and the nature of the soil were at work to bring about the decay of the pipe; or, in other words, a voltaic energy accelerated a chemical change in the carbon and iron of the piping in presence of some acid in the soil. He did not, however, think they were able to decide this point. With regard to Mr. Dalziel's remarks, he did not think he had proved the law of exosmosis sufficiently, because if the gas was turned off at the meter before it was turned off at the brackets, when it was again lighted, a certain amount of air would pass off before light was obtained; but if the gas was turned off at the brackets and then at the meter, the gas could be lighted the moment it was turned on. Mr. M'Gilchrist wished to put Mr. Dalziel into a corner with reference to pressure; but he (Mr. Niven) thought it was unnecessary, because if there was a gain to a gas company in the way of greater volume on account of the difference of barometric pressure, then by a parity of reasoning there was a loss arising from the reduction of pressure. It came, then, to this—that managers liked, if possible, to have their works on as low a site as they could procure.

The PRESIDENT thought the cause of a great deal of leakage in some towns was the condition of the meters. He knew that in Port-Glasgow a considerable portion of the leakage was due to this cause. He had, he said, tested a good many meters during the previous 18 months, and in many instances they were condemned. If meters were constantly watched and properly watered, so as to keep them going correctly, the consumption of gas would be found to be greatly increased. It would generally be found to be the case that when a new meter was substituted for an old one, there was an outcry about so much more gas being used. His experience compelled him to say that another source of great leakage was to be found in the service-pipes. In Port-Glasgow he had overhauled a great many of the services, put on valves, and divided the whole town into districts. He fitted valves upon the mains, from 12 inches down to 7 inches, and put a pipe on each side of the valve, and fixed a meter between the valve. He then shut the valve, and passed the gas from the one pipe to the other, taking care that the different sections were turned off, and in this way he ascertained whether there was any leakage in the section he was testing. He found that the large mains were in comparatively good order, but in some of the smaller mains he discovered a great deal of leakage. In some instances the source of the leak was at a great distance from the place where the smell of gas was first discovered. Some of the pipes—he could not tell how long they had been underground—were not in a bad condition, especially where they had been laid in a clayey soil; but where they had been laid among ashes they were in a rotten state. They seemed to have been eaten as if by acid, and upon the application of the slightest pressure they would snap like a pipe-shank.

Mr. R. MITCHELL (Coatbridge) read the following paper, entitled,

NOTES ON THE VALUATION OF GAS-WORKS.

It is not my intention at the present time to enter into this subject on the broad basis of valuation of works, such as in cases of transfers from companies to corporations. I will content myself by making a few remarks on the rateable value of gas undertakings, and how to arrive at it.

I fear this subject does not receive that amount of attention which it claims from us as managers of companies. Too much is often left to the assessor, who, not perhaps from any desire on his part to overrate, but from zeal in the interest of his district, omits the consideration of the nature of the property and its ramifications, and places a rental upon it which would bear no comparison with other undertakings having the same turn-over, and, may be, greatly increased profits.

I consider it most essential that there should be a recognized mode of valuing gas undertakings, so as to arrive at the yearly rent, or rateable value from year to year, for parochial and other assessments. To arrive at this we must have a basis, and must have recourse to the balance-sheets and books of the company, in order to ascertain the profits accruing from the undertaking, as this is really the groundwork for determining the rent which the concern could be let at from time to time. Some might say this should not be so, because if a good year's profit is made, the tenant of the works is not benefited as he ought to be, having thus increased taxation. A fixed principle must be adopted, and if certain conditions are observed, I consider nothing fairer can be laid down.

Having arrived at the profit made in one year by a company, and the value of the works occupied by them, no tenant or outsider could or would give a rent equal to that amount; still there are works rated upon their entire profits as rental, and one instance I know where the rateable value exceeds the year's profits by nearly £400. This would simply mean ruination. What would come over the interest on the tenant's capital required to carry on the works? What would become of his stock-in-trade, his retorts, meters, and other appliances, not to speak of his remuneration for time spent in superintending and carrying on the works?

To enable a man to do legitimate business, he must deduct from his gross profits such amounts as will enable him to carry on his business, allowing for all risks and repairs—giving him a fair interest for the capital floating, say at 4½ or 5 per cent. interest on the capital represented by him in meters, retorts, &c., at the same rate, and then his own remuneration, which should not be less than 10 per cent. on the total amount of the capital employed. Until this subject has the consideration of every manager, we shall not be without cases parallel to the following:—

	Cub. Feet.	Last Year.	This Year.
Works making	40 million	£1250	£1800*
" "	35 "	400	1000
" "	18 "	entire profits	
" "	20 "	1016	1016

When the town or district is supplied by a corporation, some of the representatives might not be inclined to look narrowly into this matter, as the rates paid from the gas-works funds would go, to a certain extent, to subsidize the local taxes; but in the case of a private company I think every manager should consider it to be his duty to lay before the assessor or his commissioners the proper state of the undertaking, and thus be saved the trouble and annoyance of attending pleading diets and appeal courts, when it is only what is right that is wanted.

Discussion.

The PRESIDENT said this was a subject requiring great attention, as a large amount of money was swallowed up by the way in which gas-works were rated; and unless assessors were checked they might be inclined to put on a little more.

Mr. RENFREW remarked that this year his works had been valued at three times the amount they stood at three years before. On making inquiries he found that the basis on which the assessor proceeded was the same as was adopted for railways, canals, and tramways—viz., the average of three years profits, deducting 20 per cent. for working expenses. There was no appeal from this valuation.

Mr SINCLAIR said an assessor had no right to look at a company's balance-sheet. He had only to know what the works cost, and what the expense of maintaining them would be, and then allow a fair amount for profits.

Mr. NAPIER could bear testimony to the accuracy of Mr. Mitchell's statements. In his case the assessor exercised his right not only to see the balance-sheet, but to examine the whole of the Company's books. He (Mr. Napier) was rather surprised to hear Mr. Mitchell say that one company was assessed to the extent of £400 a year. The assessor told him that it was a recognized rule throughout Scotland to take the gross profits of five years, and allow 15 per cent. as tenant's profits on two-thirds of the working expenses. He took some trouble in preparing a statement so as to meet the assessor. He was asked to put himself in the position of a hypothetical tenant. The gross profits for the last five years were taken at £650; the assessable rental was put down at £470. Then he found that in his case the Company did not insure the works fully. He would insure up to the full amount, and if he were to take a lease of 50 years, the price and quality of the gas would be fixed. He would require at least £40 to pay interest on the working capital. Then he would require to give the Directors a guarantee that he would implement his contract, and for this guarantee he would require to pay £25. Then, in order to put the works in the same state as that in which he found them, he would require at least 1½ per cent. on the subscribed capital of £4000, and this would be £60, making a total of £625, which would leave £25 to himself as Manager. This state of affairs was submitted to the assessor, and the Company obtained a reduction from £470 to £375.

Mr. SINCLAIR inquired whether this was the income-tax assessor or the valuation assessor.

Mr. NAPIER replied that it was the valuation assessor. The Company sent in a statement which was evidently not satisfactory, and the assessor called to see the books.

Mr. M'GILCHRIST said he could assure Mr. Sinclair that companies did not generally get on so well with the assessors as he did. In Dumbartonshire they had had a great deal of trouble. The assessors seemed to have no fixed law upon which to proceed, and they appeared to lay on the assessment as heavily as they possibly could. The rates took more than 2½d. per 1000 cubic feet of gas sold in Dumbarton, while in some other towns it was scarcely 1d. per 1000. The Renton Company had more than once appealed against the assessor's valuation, and the gentleman representing the Company put forward a very fair system. He said, "We will allow you to assess us upon the amount of profits we pay to the Shareholders." He (Mr. M'Gilchrist) thought no better basis for valuation could be than that of assessing upon the profits paid to the shareholders of any company. It would save a great deal of trouble, and be satisfactory to all.

Mr. JEFFREY (Kirkintilloch) remarked that as the assessors seemed to have no fixed method of valuating, it would, in his opinion, be a good thing if corporations and gas companies would amalgamate, and have the question properly settled, so that all gas companies might be put upon the same footing.

Mr. RENFREW said he went to a lawyer and asked him whether it was worth while to appeal, and the lawyer said, "No." According to the Act for assessing these companies, they were charged upon the average of three years profits.

Mr. MITCHELL, in reply, said he was glad the paper he had read had brought out such a discussion, and he thought Mr. Jeffrey's remark about amalgamation, in order to have this matter definitely settled, was very pertinent. He did not see that the assessor had a right to put on any valuation he pleased. In the assessor's office in Glasgow he remembered seeing the names of three companies who appealed against the decision of the assessors. One of these was the Inverary Gas Company, and in their case the Court at once agreed to reduce the rental.

(To be continued.)

AMONG the awards at the recent "International Food Exhibition," at the Agricultural Hall, we notice the following:—Silver medals to Messrs. Henry Greene and Son, for cooking apparatus, and Mr. P. A. Maignen, for his "filtre rapide." A bronze medal to Messrs. H. and C. Davis and Co., for gas-cooking stoves. A certificate of honourable mention to Messrs. West Brothers, for gas-cooking stoves.

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* In this case the valuation was increased, without any known cause, from £1950 to £1800. This was appealed against; and the Court, after considering the facts, agreed that the rent for the current year should be £1100, which made a reduction on the taxes of £75 16s. 8d.

NOTES FROM SCOTLAND.

(FROM OUR EDINBURGH CORRESPONDENT.)

EDINBURGH, *Saturday*.

Complaint as to the scarcity of water in Scotland may sound strange to those who live beyond the kingdom, and who have hitherto been under the delusion that for the greater part of the year its valleys and its mountains are enshrouded in drizzling mists; but it is stranger still that complaint on this score should first come from Greenock, which has always been recognized as the head-quarters of Jupiter Pluvius. During the past few months the tutelar saint seems to have withdrawn his protecting power, with the result that Loch Thom, whence comes the main supply of water for manufacturing purposes, is almost dry, and the authorities, in order to secure what little remains for the use of the public, have intimated to several of the large manufacturers of sugar that unless the store of water at their disposal is suddenly increased, the supply must cease. On the 1st of April last Loch Thom contained 232,435,350 cubic feet; but taking into account the Gryffe reservoirs, compensation and other reservoirs, the quantity of water then in store amounted to 446,704,864 cubic feet. Comparing this year with last, the rainfall has decreased from 38·22 inches to 31·57 inches —a serious deficit in a district where so much water is annually required for business purposes. It is hoped that the heavy storm of Wednesday and Thursday has so far replenished the available supply as to enable the manufactories to continue, as their stoppage would necessarily throw a large number of the workpeople idle. But Greenock has not been the only sufferer by the long-continued drought. On the other side of the channel, Dumbarton is in extremities, while in Stirling, Inverness, and many other towns, the water supply is limited to a few hours per day.

Although Dundee has spent upwards of £300,000 on the Lintrathen scheme, the inhabitants cannot yet be said to be in the position of having a constant supply. This arises not so much from the want of water, as from inability to convey it safely to town. Such is the great pressure, that "bursts" along a particular branch of the line are of very common occurrence indeed. The question has now been raised in Dundee whether a Bill should not be immediately prepared, and the necessary parliamentary sanction obtained to lay down new pipes with the view of strengthening and improving the carrying power from Lintrathen to the Clatto reservoir; to construct filters to make fully available for domestic supply the Moniki waters; to include within the limit of supply the town of Newport, which, it may be remembered, was deprived of water by the fall of the Tay Bridge; to increase the borrowing powers of the Commissioners; and to suspend the sinking-fund for other five years. To overtake the necessary works here indicated, it is calculated that the sum of £55,000 will be required. This proposal was brought under the notice of the Commissioners on Thursday, but as the annual election of Commissioners takes place on the 2nd of November it has been considered advisable to allow the matter to stand over to await the decision of the newly constituted Commission.

The town of Paisley is about to apply to Parliament for powers to introduce a new water supply, at a cost of something like £100,000. The water is to come from the parishes of Dalry and Largs.

Turning attention from water to gas, I have to announce the demise of a Gas Company. "Men may come, and men may go," but gas companies are supposed to "go on for ever," and it is therefore rather startling to hear of the winding-up of such a concern. In Thurso, which may be called the Ultima Thule of Scotland, the old Gas Lighting Company has put a period to an almost unproductive existence of 35 years. The shares of the Company were 50s. each, but unfortunately the Shareholders have never had anything like a proper return for their money. It is not often that the purchase of gas stock turns out an unprofitable investment, but in this case only two dividends of 10 per cent. each have been paid. Now that the manufacture of gas has ceased, the Shareholders have the melancholy satisfaction of getting their 50s. per share returned, with 4s. 1½d. added for the lengthened use of the money. The end of the first chapter of gas lighting in Thurso is anything but pleasing. It is astonishing that in a town with nearly 4000 inhabitants, gas could not be made and sold at a profit. Of course, it must always be borne in mind that there was no access to Thurso by rail until some six years ago, and that it is distantly situated from the coal-fields. Besides, in these high latitudes, the northern lights are brilliant, and possibly the frugal inhabitants of the town did not urgently feel the necessity of burning gas at 12s. per 1000 cubic feet, the price charged by the Company.

It is a long journey from Thurso to Dumfries; but the transition is pleasant, and in passing along I observe that Mr. Smith, of Aberdeen, has been able to take another 1d. per 1000 cubic feet off the price of gas. The present rate is 4s. 2d. Considering the heavy carriage Mr. Smith has to pay, and the rich quality of the gas which he supplies, the inhabitants of the city ought to be highly gratified at the comparatively low rate which they are charged for gas.

If in the extreme North there has been an absence of prosperity, in the extreme South there has been abundance of it. This was not always the case in Dumfries, and it is satisfactory to learn that not only has the tide of success fully set in, but that there has been a sinking of little personalities. Through the exertions of the Manager, the gas undertaking of the town is now in a prosperous state. The Commissioners have been able to make up a loss of £1060, incurred during the past financial year, and to set aside £300 for an insurance-fund, carrying over a balance of £736, besides reducing the price of gas to 5s per 1000 cubic feet. These figures are such as to encourage the hope of still further reduction in future years.

A very few miles separate Dumfries and Dalbeattie, famous for its granite quarries; but there is a wide difference in the price of gas in the two places. At present it is sold at something like 9s. 2d. per 1000 cubic feet, and local agitators are beginning to ask the question, "Why should we not be able to get gas at 5s.?" The Commissioners of the town and the Company seem to experience difficulty in coming to an arrangement as to the public lamps, and the former are evidently quite prepared to teach the Company that oil is a formidable rival to gas for public lighting.

About two years ago a Company was formed to carry on the manufacture of oil from shale in Fifeshire. The *locus* of the Company was in the neighbourhood of Burntisland, in the very centre of a rich shale district, and here they have attained considerable commercial success; but unfortunately for themselves they emptied the refuse of their works into a small stream which flows through the property of a Mr. Kirke. He, first in the Inferior Courts in Fifeshire, and latterly in the Supreme Court here, sought to interdict the Company from continuing this polluting process. The Court, while anxious to preserve the rights of riparian proprietors, did not desire to put an end to the manufacture, if the nuisance could be possibly obviated, and they accordingly remitted to Mr. Cunninghame, C.E., to report on the subject. This gentleman gave in a report in which he recommended the construction of evaporating ponds, and the Court fixed two months or so as the period within which the Company should carry out this improvement; but the Company thought they saw another and a better way of getting over the difficulty, and they proposed to carry a pipe from their works to the main sewer of Burntisland, and in this way empty the refuse into the sea. Moreover, they calculated without their host. The necessary way-leave was for a time refused; the period allowed by the Court had expired; and Mr. Kirke was obdurate. He insisted upon having his "pound of flesh" in the shape of interdict, and he got it, with the result that the works were stopped and 400 men thrown out of employment. Now, however, the Company have got way-leave, and they expect shortly to apply to the Court for removal of the interdict. But they have another difficulty to face. Mr. Kirke accuses them of breach of interdict, by allowing polluting matter to reach the burn. This charge the Company deny, and the Court have ordered evidence to be given on the subject.

(FROM OUR GLASGOW CORRESPONDENT.)

GLASGOW, *Saturday*.

The Glasgow Exhibition of Lighting and Heating Appliances, &c., has been brought to a close to-day. From the large number of visitors that have flocked to it latterly—upwards of 2700 passing the turnstile to-day—as also from the remarks that many of them have been heard making, it is abundantly evident that there has been a widespread desire that it might remain open for some time longer. Indeed, a similar feeling seems to have taken possession of many of the exhibitors and attendants to-day; but, of course, it is now too late to make any overtures to the Executive Committee for it to be continued open another week. Many of the exhibitors certainly did a large and encouraging business, and hence might well feel desirous that the exhibition should remain open at least for a few days additional. The testing of the apparatus is not yet complete. In connection with the electric light exhibits, the jurors will be at work again during the ensuing week, more especially with the Brush system of electric lighting. The jurors in the sections of gas-cooking stoves and heating appliances have likewise still some work to overtake. Last evening no fewer than nine cooking stoves were engaged in the practical work of roasting a leg of mutton and baking at least three 2 lb. loaves of bread, under the surveillance of Mr. G. R. Hislop, of the Paisley Gas-Works; Mr. S. Stewart, of the Greenock Gas-Works; and Messrs. Thornton, cooks and restaurateurs; and during the progress of the work there was a great amount of excitement along the middle line of the exhibition hall, where the cooking stoves were arranged. On the preceding day there were many visitors from Edinburgh, that being the Autumn Sacramental Fast-day in the Edinburgh district; and here it may be worthy of mention that in numerous instances during the period of the exhibition a desire was expressed that the whole contents of the exhibition hall might be lifted bodily and taken to that city by the Glasgow Committee. Of course, they had no authority for even attempting to carry out such an idea; but there is every probability that a movement will forthwith be made in Edinburgh with the view of following the excellent example that has been set by the Philosophical Society of Glasgow. A Past-President of the Royal Scottish Society of Arts is not unlikely to make a move in the direction referred to.

A keen feeling seems still to exist in Hamilton as to the impropriety of the large expenditure recently incurred in connection with the gas-works under the management of the Town Council. Mr. Rae, one of the members of Council, when addressing his constituents a few nights ago, said that the gas in the old times had an illuminating power of from 30 to 35 candles, whereas the report for September showed that it was under 28 candles. The price is 3s. 9d. per 1000 cubic feet at present, and but for the recent expenditure he was of opinion that they might have had it for 3s. 4d. per 1000 feet. At another meeting, addressed by Bailie Cassels, the Convener of the Gas Committee, that gentleman said that in 1877, the last year of Mr. Tainsh's convenership, while the average price paid for coals was 7s. 6¾d. per ton, consumers were charged at the rate of 4s. 2d. per 1000 cubic feet of gas, and that with all their additional outlay, and paying 9s. 11½d. per ton for coals, they were supplying gas to the consumers at 3s. 9d. per 1000 feet, which was a saving to the community of upwards of £700 on a make of 34 million feet, or equal to a reduction of taxation of more than 3d. per £1 on the rental of the burgh. The make of gas, according to Bailie Cassels, was 19 million cubic feet per annum in the year 1873, whereas it rose to 29 million feet in 1878, and to rather over 34 million feet in 1879, and at the present day it is at the rate of 35 million feet.

A candidate for municipal honours at Kilmarnock, Mr. Kennedy, has addressed two meetings of electors this week, and in the course of his speeches he gave prominence to the gas question. He said that gas of a high illuminating power always had a low heating power. As a convenient and cleanly means of cooking, and driving sewing and other machines, the heating power of gas seemed to be too much overlooked. The gas in London, of 16-candle power, had double the heating power of the gas used in Kilmarnock, and was consequently better adapted for a motive power than the local gas. If the use of gas was extended to such things, there would be, he thought, a very largely increased consumption. He knew of one establishment in the town—a soda-water manufactory—where gas was used as a motor, and he understood it was giving great satisfaction. There seemed to him a wide field of extension in the use of gas, which, if made available, would lessen the price. He was also strong on the question of meter-rents, which he would continue; and on this matter, Bailie Moffat, chairman of one of the meetings, said that the capital invested in the meters of the town was about £7000. The rent drawn from them was £540, and about £200 was spent yearly in their maintenance, thus leaving little more than £300, or about 4¼ per cent. on the capital sunk.

The electors of Airdrie seem to be determined to press their Town Councillors to consider the question of taking over the gas supply of the town. The same subject is likely soon to receive the attention of the Police Commissioners of Motherwell.

Glasgow 6¾ per cent. Gas Annuities have been selling during the week at £165 7s. 6d. per share.

The Glasgow pig iron warrant market has been irregular, and much under the influence of speculative movements. Yesterday it was very strong in consequence of rumoured buying for America, prices advancing 10½d. per ton. The market closed with sellers at 51s. 8d. cash and 51s. 10½d. one month, buyers offering ¼d. per ton less.

There is a somewhat better demand for coals, both for house and shipping qualities, and prices tend to firmness.

A STRANGE NOTICE TO GAS CONSUMERS.—Complaints are frequently made of the way in which consumers are treated in this country by non-statutory gas companies; but seldom, if ever, has it been necessary for such a notice to be issued to them as the following, which has been sent to us, the Gas Company referred to having works in one of the British Possessions:—"Sept. 23, 1880. Notice to gas consumers. The Manager of the Gas Company regrets it is his painful duty to inform the consumers of gas that, in consequence of the Company not having taken the necessary measures for the renewal of the works requisite for the production of gas —those now in use having been so for three times the usual period—the supply of gas must be discontinued, after the 24th inst., until these renewals are made. The Manager will endeavour to renew the supply of gas in the course of a week."

OPENING OF NEW WATER-WORKS FOR THE DONCASTER CORPORATION.

On Wednesday last the new water-works which have, for the past six years, been in course of construction for the Doncaster Corporation at Thrybergh, about four miles from Rotherham, were formally opened by the MAYOR (Alderman R. E. Clark).

The works are of considerable extent, and have cost about £200,000. The first sod was turned in September, 1874, and the foundation-stone laid on the 16th of December of the same year; and since this time the work has been carried on by the Resident Engineer and the Contractor. There are three reservoirs, the principal one, at Thrybergh, having an area of about 60 acres; and the other two, situate at Silverwood and Ravenfield, which act as feeders of the main reservoir, cover a combined area of between 15 and 20 acres. The three reservoirs will provide capacity for holding 250 million gallons of water, which will be gathered in the neighbourhood of Silverwood and Micklebring. This is admittedly a very fine watershed, and by means of the new works the inhabitants of Doncaster will be placed in the possession of a supply of water of great excellence, of which they have long been in need. Up to the present time the water for culinary purposes has had to be pumped from wells in various parts of the town, and that for domestic and manufacturing requirements has been pumped from the Don. To give the reservoir the desired capacity, a depth of 62 feet was determined upon; but owing to difficulties experienced as the work progressed, a depth of at least 100 feet had to be gone to. This was occasioned by the fact that when the basin was prepared for the reception of the water, and it was filled, the water began to disappear. The cause was ascertained by further digging. It was discovered that instead of there being a firm bottom, there was a rock below which contained an immense fissure. The leakage on this account was serious, and it was decided to go down as far as the blue shale. This delayed the opening of the works for at least twelve months. The difficulty has, however, now been satisfactorily overcome, the bottom of the basin repuddled, and the reservoir filled within 5 ft. 6 in. of the high-level water-mark, at which it will contain 230 million gallons. The filter-beds for the three reservoirs have been fixed on the left hand of the main reservoir. The filters are composed of various layers of gravel and sand, each 6 inches in thickness. First, however, come the perforated pipes, laid in rows, then a layer of broken stone, and lower down come various beds of walnut gravel, beans gravel, peas, shot gravel, and finally 2 feet of Trent sand. A meter-house has also been constructed, by which the amount of water supplied daily will be registered. The water will have to be carried about 8 miles before it reaches Doncaster. It will first run by gravitation direct from the main reservoir to Warmsworth, where a service reservoir has been placed. Tunnels have had to be made, the chief one being at Denaby, through which pipes have been laid for the passage of the water. A tunnel, called the Conisbro' Park tunnel, has also been constructed, to carry the water from the Conisbro' Park stream to the reservoir; whilst a 4-feet diameter conduit, a mile in length, has had to be laid to connect the Ravenfield reservoir with the main one at Thrybergh. A large and commodious house has been erected near the embankment of the Thrybergh reservoir for the accommodation of the Manager, who will always reside on the spot.

Upon reaching the principal reservoir, the Mayor, who was attended by the officials and members of the Corporation, proceeded to the lower part of the embankment, where the formal turning on of the water took place, the Engineer (Mr. B. S. Brundell) having handed to the Mayor a key for the purpose. The Mayor, after he had turned on the water, delivered an address, in which he congratulated the burgesses on the completion of the works. The company then returned to a large marquee erected near the embankment, and partook of luncheon, upon the conclusion of which several toasts were drunk, including "Success to the Doncaster Water-Works," which was proposed by the Mayor, who stated that when full the large reservoir was calculated, without rain, to supply the town of Doncaster for 240 days. In the evening there was a banquet in the Mansion House to celebrate the event—the Mayor presiding.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

In this district prices generally are hardening so far as round coals are concerned, and buyers coming into the market have now to pay higher prices than would have been accepted a short time back. With the commencement of November a general advance is being carried out in the Wigan district, ranging from 6d. up to 1s. per ton in some cases. This, however, does not so much represent an actual advance upon the list rates, which during the summer have been little more than nominal, as upon what have been the real selling prices, and it is questionable whether, in the face of the agitation on the part of the men for an advance of wages, colliery proprietors will carry out any very material upward movement, which, whilst being only temporary, might lead to higher wages being paid, which would probably be permanent. In the Manchester district a further advance of 10d. per ton is being made in the delivery rates to private consumers, but pit prices are not undergoing any very material change. Classes of fuel for manufacturing purposes are not being affected to any very appreciable extent by the upward movement in values, and large consumers for ironmaking and steam purposes are able to place their orders on pretty much the old rates. Engine classes of fuel continue remarkably firm, considering the largely increased production of slack, and it is only in exceptional cases where any concessions are at present being made. The average prices at the pit mouth are about 8s. 6d. to 9s. for best Wigan Arley, about 6s. 6d. to 7s. for good second qualities, about 7s. for good Pemberton four-feet, 5s. to 5s. 6d. for common coal, 3s. 9d. to 4s. 3d. for burgy, and 3s. to 3s. 6d. for good slack.

Although there is no really stronger tone in the iron market, the amount of business doing during the week has been larger, so far as pig iron is concerned, and local makers have effected some tolerably good sales for delivery over the next three or four months at about late rates, which range from 46s. 6d. to 47s. 6d. per ton, less 2½, for delivery into the Manchester district. Finished iron has been only in dull demand, and although £6 per ton is the average quotation for bars delivered into the Manchester district, there are sellers who would take as low as £5 15s. for prompt specifications.

NOTES FROM MONMOUTHSHIRE AND SOUTH WALES.

(FROM OUR OWN CORRESPONDENT.)

There has been a falling-off in the quantity of coal shipped at Cardiff during the last week to the amount of 45,564 tons as compared with the previous week; but 9926 tons of iron were exported, with a fair amount of fuel and coke. The shipments of coal at Newport for the last week show an increase of 9946 tons when compared with the previous one. In many instances prices remained firm. Employment at the iron-works is considered fairly good. There was a decided improvement in the demand for iron. The returns of the steam coal shipments at Swansea for the last week show a falling-off of over 2000 tons, and in patent fuel of nearly 1000 tons when compared with the previous week. This is attributable to a great extent to the want of tonnage, and not so much to the want of orders. The prices of all descriptions of steam coal remain very dull, and at the present time an advance is not looked forward to favourably. The local works are fairly active in the metal department. Iron is more steady; it is the opinion that the minimum price has been reached, and it is expected that buyers who have been holding back will now come forward with orders. £5 to £5 5s. per ton is quoted f.o.b. Welsh ports for new iron rails, old rails being offered at about £3. The demand for scrap is *nil*. Steel rails appear to be in fair request at prices ranging from £6 to £6 5s. per ton f.o.b. Some of the local works have been fortunate in securing several good contracts. No improvement is shown in regard to tin plates. Several large parcels are reported to have been sold through second hands at very low prices.

At the Tredegar Iron-Works a new blast furnace—the fourth of the kind—was blown in a short time ago, and is now in full operation. These furnaces are producing a large quantity of the celebrated Tredegar pig iron, which realizes the highest quotation in the market. Two of Cooper's stoves are attached to the furnaces, the first of similar construction that have been introduced into this district. The new coke ovens are doing good work, and the coke is of the best quality. The automatic arrangements for filling the ovens and drawing the coke possess many of the most recent improvements, no manual labour being required from the time the coal reaches the bunk till it is emptied into the trucks in the form of coke, and the coal is screened, washed, taken to the oven, and withdrawn entirely by machinery. The whole arrangements at the furnaces and coke ovens give evidence of the most advanced acquaintance, on the part of the management, with every scientific and practical point connected with the production and manufacture of iron, and places the Tredegar Iron-Works in a prominent position amongst kindred industries throughout the country.

In the colliery department unusual activity prevails, the work of sinking a new pit at Darran being pushed forward with all despatch, and when completed it will afford employment to some hundreds of hands. The celebrated steam coal vein will in time be reached by the aid of the diamond drill, which is now being used in the sinking operations. The quantity of coal and coke sent off daily over the North-Western Railway system is a proof of the great revival which has been experienced of late in these particular branches.

THE SOUTH STAFFORDSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Both coals and coke are experiencing an improved demand in this district. The markets, too, for the last week, have been noticeably stronger, as all kinds of household coals are more eagerly sought after. Quotations, however, are but little different from those that have ruled for the past months. It is pretty generally believed that a rise in the price of all ordinary kinds of fuel raised in this district will shortly be made. Nothing of a definite nature has as yet been resolved upon, and beyond the strength of the demand, and the inclination of colliery proprietors to hold back quotations for large contracts and inquiries, there is no difference of a marked character notable in the trade. Furnace fuel, and, in fact, all other kinds of manufacturing sorts, are still of slow sale. There is perhaps less underselling, and scarcely so much activity on the part of some of the local coalmasters to obtain contracts for the supply of local consumers.

The iron trade is unmarked by any signs of improvement, and the demand is scarcely so good for finished iron as it was a fortnight ago. The Wolverhampton market on Wednesday was but thinly attended, and orders were somewhat scarce. The most taking kinds of finished iron were perhaps sheets, hoops, strips, and a few others of the miscellaneous class. Bars were in but very dull request. A few inquiries for girders for export, and for tube strip, were the most notable features of the finished department. Unmarked bars were quoted at £6 5s. to £6 10s. The pig trade was also unusually dull, and the nature of the business transactions was of the most unimportant character. Small lots of part-mine, and also of cinder pig, comprised the principal of the business transactions. The tone of the Birmingham market on Thursday, though slightly better, was still below its ordinary state. Puddled bars received the greatest number of calls, and some few sales of a respectable class were reported to have been made. All-mine, cold-blast, and cinder pig were the kinds receiving most attention in the raw material. Cokes sold well, and there are a greater number of inquiries for the better class, and rates, too, are reported to be slightly higher.

THE YORKSHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The general coal trade at both the South and West Yorkshire collieries may now be said to be active, there having been great improvement during the past few weeks. There can, however, be no doubt that prices have not improved in proportion to the increase of trade, and this can readily be conceived when it is stated that the output is still greatly in excess of the demand, although many collieries are not raising anything like the quantity they could, did circumstances require them to do so.

The business doing with London by rail from South Yorkshire is fairly active, but complaints are rife that the tonnage rates greatly operate against sales. The Great Northern Railway is conveying a large tonnage from Hexthorp, where it is handed over to them by the Manchester, Sheffield, and Lincolnshire Company. A very fair quantity is also taken from a number of the collieries in both districts by the Midland line. A marked improvement is reported to have taken place with respect to the business doing with the Eastern Counties, which just now displays more activity than for some months past. More is also required for the local markets, so that both the Silkstone, Barnsley, and Haigh Moor seams are more largely worked.

Discouraging reports are in circulation with respect to the business doing in steam coal, and the prospects of the immediate future. Some of the contracts placed for export coal are drawing to a close, and the prospects for the winter months are said to be discouraging. As yet, the tonnage for Hull and Grimsby holds well up; but, owing to the hard and soft coal having to be obtained from the same seam, some portion of steam coal will shortly have to be stacked.

A good deal of Silkstone coal is just now being used for gas-making purposes; in fact, it is said that the consumption of this class of fuel is larger at the present time than it has been for a long period; the Barnsley and some other gas-works making almost exclusive use of it. The locomotive coal is still largely supplied according to contracts entered into some time ago with several of the leading Railway Companies.

Other kinds of fuel, including coke, have of late undergone but little alteration. Makers of coke are turning out a large tonnage, a considerable quantity of which is finding its way daily to the North Lincolnshire district, where it is used for iron-smelting purposes, there being a large number of furnaces in blast.

The iron and steel trades are in much the same state as when last noticed. There is still an average output of pig iron made, but work at the various foundries is not over active, save in special departments, where large gas and water pipes are produced. The steel trade is still pretty active, as at works where Bessemer steel rails and tires are produced the men are working full time.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

October will be memorable in the annals of the gas coal trade of the North of England through the enormous loss of small sailing vessels, usually employed in this trade, which occurred in the last week of the month. Wrecked vessels strew the coast from Berwick to the Humber. And the wreckage of the same sort of little ships upon the Lincolnshire and Norfolk coasts is unprecedented. It is so serious that as the same kind of vessels will never be rebuilt, it will probably precipitate a revolution which has been impending in the sea-borne coal trade—the substitution of a small class of steamers, small tenders, and 14-keel brigs and schooners. Any way the loss is a grave one, and it is likely to disarrange the carrying of gas coals to many of the larger ports over the winter months. The vessels whose career has thus been ended belonged to nearly every small port between King's Lynn and Devonport, and the slaughter of these ships (though in a much less degree of their crews) has been fearful. The gale of Wednesday, Thursday, and Friday found a large number of small ships at sea, and some of them had been knocking about for a month, and had made little progress. Merchants and colliery officers had been short of tonnage, and had experienced much difficulty in completing their orders before the storm arose. But their troubles have been vastly increased through the effects of it.

The gas collieries would show an active business, provided the tonnage were forthcoming and were kept in regular supply. A quantity of gas coals were standing at the dock heads in trucks waiting the arrival of the gas coal steamers, which had been thrown out of the regular course by the gales which raged last week.

The price of gas coals is not materially altered one way or the other. Contracts are running very well, but few go beyond twelve months. No doubt the periodical revival of the electric light scare may have something to do with it, for whilst very few, if any, are timid about the future of the gas coal trade, these wild rumours of discoveries have the effect of inducing caution in making long engagements. Ordinary kinds of coals improve in value, whilst the demand for steam coals is mainly for best qualities. The quotations for coke for shipment have improved. The business which was transacted last week in small and manufacturing coals was pretty good.

The ordinary Baltic trade is drawing to a close. During the early part of this month medium-sized steamers will come out of it, and go into coasting. There will therefore be a larger supply of the useful class of tonnage at the disposal of the gas trade.

The manufacturing trade of the north-east ports, especially in bricks, chemicals, and cement, is very quiet. Manufactured iron is likely to show an advance in price between this time and the spring. Lead has improved in value at the last sales, which took place on the Tyne last week. Timber of all descriptions is quite equal to the demand. It is found impossible to establish an advance in the price of it.

THE WATER SUPPLY OF BRADFORD-ON-AVON.

At the Meeting of the Bradford-on-Avon Town Commissioners on the 19th ult.—Mr. T. B. SAUNDERS in the chair—a report was presented from the Water Committee relative to obtaining a supply of water for the town from Avoncliff, where two shafts had been sunk, and samples of water taken for analysis. Such analysis had been made by Mr. Stoddard and Dr. Frankland, and the Committee reported that after perusing the reports furnished by these gentlemen, they felt satisfied that the quality of the water was good, and the quantity available quite sufficient for the supply of the inhabitants. They accordingly recommended that the analyses, or copies of them, should be forwarded to the Local Government Board for their consideration, and that they be asked to sanction the obtaining of the supply of water for the town from this source instead of from the wells originally proposed, and that the Board be asked to allow such modifications to be made in the scheme approved of by them in August, 1878 (when they sanctioned the loan of £6000), as would enable the Commissioners to carry out these recommendations, having regard to the proposed new source of supply, and the consequent alteration in the estimate of the costs of the works.

Mr. WILKINS, in moving the adoption of the report, said the question of the water supply had been a very trying one, and he hoped that in the event of the Local Government Board sanctioning the proposed scheme, the Commissioners would find water which would be advantageous to the inhabitants. If it should be turbid, the best plan would probably be to have filter-beds. With these they would have water as good as, or better than any in the neighbourhood.

Mr. WILSHIRE seconded the motion.

The CHAIRMAN remarked that he did not see it mentioned in the report that the water had risen or fallen more than 2 inches. There certainly were points he thought the Committee had overlooked. He wished to get a good supply of pure water for the town. It was not for him to give an opinion on the analyses—this he left entirely to scientific gentlemen; but he did not like the word "turbid," any more than he did the statement that the water was "fairly good potable water." He would rather see it classed as "A 1."

Mr. WILKINS said the desire of each and every one was to get a good supply of water for the town. Some of the Commissioners took one view, and some another, but they might depend upon it the Local Government Board would take good care they did not sanction a scheme they did not think desirable for the town. An Inspector would be sent down, and he would approve or disapprove of the proposal. He asked them to remember that the work of the Committee was of a preliminary character.

The motion for the adoption of the report was then put and carried.

SALE OF GAS AND WATER SHARES AT CHATHAM.—On Thursday, the 21st ult., Messrs. Kidwell and Son offered for sale, by auction, two £12 10s. "B" shares in the Rochester Gas Company, which were purchased for £40 10s.; and two similar shares were sold for £41 5s. Six Rochester Water Company's shares were sold at £10 12s. 6d. per share; while six £10 "B" shares in the Sheppy Gas Company, entitled to a dividend of 10 per cent., were bought at the rate of £20 15s. per share.

FATAL ACCIDENT AT THE PLYMOUTH GAS-WORKS.—On Wednesday last an inquest was held at Plymouth relative to the death of William Elliott, a blacksmith in the employ of the Plymouth and Stonehouse Gas Company. From the evidence adduced it appeared that deceased was engaged on the previous day, together with another man, in cleaning out a scrubber, when he suddenly fell backward to the ground, and was killed instantaneously. No blame was attached to any one, and the jury returned a verdict of "Accidental death," but recommended that railings should be put round the tops of the scrubbers, to prevent similar accidents.

THE POLLUTION OF STREAMS.—At the recent Congress of the Social Science Association in Edinburgh, Dr. Stevenson Macadam read a paper entitled, "What are the means which should be adopted for the Prevention of the Pollution of Streams, without undue Interference with Industrial Operations, and for the Preservation of Pure Sources of Water Supply?" Dr. Macadam remarked at the outset that the subject was one of national importance. In a restrictive view the matter might be confined to riparian proprietors on the one hand, and manufacturers, lessees of mines, and town authorities on the other; but, on a wider view, the matter affected the whole country, for all were directly or indirectly interested in the preservation of pure sources of water supply. Any one acquainted with the river systems as a whole would admit that year by year the pollution was increasing, and that the streams were sadly deteriorating. Where improvements had taken place, these had been carried out, not voluntarily by the polluters, but under the more or less compulsory powers obtained by those who suffered by the pollutions. In the suggestion and adoption of remedial works for the treatment of impurities from mines, manufactories, &c., he had been called upon to take an active part, especially during the last ten years. Reference was then made in detail to the nature of the pollutions from mines, paper-mills, paraffin-works, distilleries, woollen-mills, dyeing of calico print-works, skinneries and tanneries, as well as town sewage, and to the various remedial measures which had been successfully carried out, and which, in many instances, had satisfied all parties concerned. The law for the prevention of the pollution of rivers was fully capable of dealing with the question, provided it was put in force. The riparian proprietors had proved their anxiety not unnecessarily to hamper commercial interests by agreeing to a reasonable compromise as to purity of discharges where the millowners had consented to execute proper remedial works, and faithfully carried them out. Powers, however, were required for inspectors to originate procedure where gross pollution was observable, and thus put a stop to the continued deterioration of the waters, and render it unnecessary for riparian proprietors to assert their rights individually.

DEATH OF ALDERMAN MOORE, OF SHEFFIELD.—Alderman Thomas Moore, who was for four successive years Mayor of Sheffield, and who, as many of our readers will recollect, took so active a part, a few years since, in opposition to the Sheffield United Gaslight Company and the Sheffield Water-Works Company, died on the 22nd ult., aged 71. In regard to his agitation on the subject of the gas and water supply, one of the local newspapers, in an obituary notice of the deceased gentleman, says that his public life was one long fight against the Water Company, and in a less degree against the Gas Company; and the parliamentary campaigns of the Town Council, almost invariably unsuccessful, were primarily initiated by him, and mainly carried out under his direction. Although his influence in these campaigns left nothing but a large legacy of costs, it is impossible to withhold a certain admiration for his earnestness of purpose, for his persistence under repeated defeats, and for a determination which knew no obstacle, and which even disease could only weaken. It was in 1864 that he commenced to display the fierce antagonism to the Water Company which was such a marked feature of his public life. The occasion was the application to Parliament by the Company, arising out of the disastrous inundation of that year. The Company, it will be remembered, introduced a clause into their Bill giving them power to raise the water-rates 25 per cent. In the determined opposition which this proposal excited, Mr. Moore took a prominent part; but though the Council adopted every possible measure to prevent the passage of the Bill, deciding at one meeting to purchase the Company's works rather than submit to the increased water-rates, it was sanctioned by Parliament, with the addition of certain requirements inserted by the Lords Committee, as to the time when a full supply of water was to be given; and the term of the increased rating was fixed at 25 years. Mr. Moore in 1855 renewed his warfare with the Water Company, who in the succeeding year applied to Parliament for powers to increase their works, and to extend the time for the completion of those they had in hand. In the same year, also, the Gas Company applied to Parliament for power to raise additional capital. Mr. Moore joined in the opposition to these Bills, both of which, however, were carried. In the case of the Gas Company a compromise was effected with the Corporation, by which the dividend on the new stock was to rise as the price of gas went down, and Alderman Saunders, who was for some time one of the Nominee Directors, reported most favourably from year to year as to the manner in which this arrangement was working. In 1867 was made the abortive attempt to establish a Water Consumers Company. At the town's meeting called to consider that scheme, its promoters expressed confidence that either the Bill would be carried or that the 25 per cent. would be taken off the water charges, but the measure broke down in its earlier stages, and the Referees awarded costs to the property owners and others who had made preparations to oppose it. In 1868, Mr. Moore was elected Mayor and Alderman; and in the following year commenced the memorable struggle with the Gas and Water Companies. On Oct. 2, 1869, an interview took place between the Directors of the Gas Company and a deputation from the Town Council, with respect to a proposed purchase of the Company's works by the Corporation, and a few days later an intimation was conveyed from the Directors to the Committee of the Council, that the Company had no wish to part with their undertaking, and were not prepared to treat with the Corporation. The result of this was that on Nov. 13 the Council, led by Alderman Moore, who had been re-elected Mayor, decided to apply to Parliament for powers to purchase the gas-works or to erect new ones. About the same time a similar campaign was opened with the Water Company, who had laid themselves open to attack by an application to the local Justices on Nov. 4 for their sanction to new regulations as to taps, pipes, and joints, consequent on the great waste resulting from constant pressure. The opposition to these proposals greatly prolonged the investigation, which was adjourned from time to time, and the regulations were not finally settled until Feb. 19, 1870. Before this, however—on Nov. 20, 1869, about a fortnight after the regulations were first submitted to the Magistrates—the Water Company had given notice of an application to Parliament to defer their obligation to give a constant supply, the Council on the same day giving notice of their intention to apply for powers to purchase the water-works. The Corporation had thus before them the prospect of a parliamentary campaign against both the Water and Gas Companies. With regard to the Gas Company, further negotiations were attempted, the Council towards the end of December, 1869, offering to guarantee the Shareholders 9 per cent. in perpetuity, or to refer the question to arbitration. This offer was refused by the Directors, who preferred to adhere to the bargain they had made with the Corporation so recently as 1868, and when the Corporation Bill came before the House of Commons Committee in April, 1870, it was rejected, on the evidence of the promoters alone, the Counsel for the Company not being required to reply. As to the Water Bills, both were withdrawn. In the preliminary stages of this contest an injunction was granted by the Court of Chancery restraining the Corporation from expending the rates in the prosecution of Bills in Parliament; but Alderman Moore and others signed a guarantee for the costs, which, however, was never enforced against them. Attempts were made by clauses in an Improvement Bill, and in the Municipal Corporation (Borough Funds) Bill, to meet the difficulty, but they were not sanctioned by Parliament. No further contest with the Gas Company has taken place; but in 1873 Alderman Moore led another attack upon the Water Company. A Bill to purchase the Company's works had been sanctioned by the Council and the ratepayers, but when

it reached Parliament the question of non-compliance with Standing Orders was raised, and the Bill was lost. By the parliamentary contests of 1870 was raised an important question, and one of deep interest to all municipal bodies. While the Bills in 1870 were under discussion, before the opening of Parliament, the Water Company filed a petition in Chancery to restrain the Corporation from applying money derived from the rates towards the promotion of those measures, and a perpetual injunction was afterwards granted. Nothing daunted, however, Alderman Moore and his supporters in the Council raised a guarantee-fund; but the costs remained unpaid for some years. On Oct. 19, 1870, the Council unanimously decided to apply to Parliament for an Improvement Act, in which clauses were inserted authorizing the payment of the parliamentary costs out of the rates. This idea was afterwards abandoned, and the Bill, bereft of every feature upon which there was any difference of opinion, was passed without opposition, Alderman Moore, who had been elected Mayor for the third time in 1870, being the principal witness in its favour when before the Parliamentary Committees. In 1871 Alderman Moore had the unprecedented fortune of being placed in the mayoral chair for the fourth time, and it was hoped that during his term of office some plan would be devised for clearing off the still unpaid parliamentary costs. The expedient of a voluntary rate was tried, but only a small sum was raised, and the illegally incurred expenses were not finally cleared away until within the past twelve months. This last and successful attempt to remove a long-standing source of discord was initiated by Alderman Mappin, M.P., and towards the sum that was raised Alderman Moore was a liberal contributor.

APPLICATIONS FOR LETTERS PATENT.

4293.—Lake, W. R., Southampton Buildings, London, "An improved apparatus for the combustion of gas, with or without other fuel, for cooking and heating purposes." A communication. Oct. 21, 1880.

4297.—Crossley, F. W., Manchester, "Improvements in gas motor engines." Oct. 21, 1880.

4323.—Ford, A., Stockton-on-Tees, Durham, "Improvements in apparatus used in the purification of gas." Oct. 23, 1880.

4338.—Wates, P. J., Balham, and Chandler, S. and J., Newington Causeway, Surrey, "Improvements in gas apparatus." Oct. 25, 1880.

4344.—Ganster, G. P., Reading, Berks, "Improvements in means or apparatus for automatically lighting and extinguishing street lamps and analogous lamps." Oct. 25, 1880.

4350.—Wirth, F., Frankfort-on-the-Main, Germany, "Improvements in automatic gas lighting and extinguishing apparatus." A communication. Oct. 25, 1880.

4361.—Johnson, J. C., Wednesbury, Stafford, "New or improved machinery for welding gas, steam, and water pipe fittings." Oct. 26, 1880.

4395.—Brodribb, C. A., Hastings, Sussex, "Improvements in gas-stoves." Oct. 27, 1880.

4398.—Rhodes, J. C., Blackpool, Goodbrand, W., and Holland, T. E., Manchester, Lancs, "Improvements in gas motor engines." Oct. 28, 1880.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

1895.—Howat, A., Manchester, "An improved method of and apparatus for holding glasses, globes, or shades for gas and other lights." May 8, 1880.

2804.—Aird, J., Lambeth, Surrey, "Improvements in or applicable to the valves of gas mains or pipes for the purpose of maintaining a tight joint." July 8, 1880.

3140.—Lake, H. H., Southampton Buildings, London, "Improvements in gas-engines." A communication. July 30, 1880.

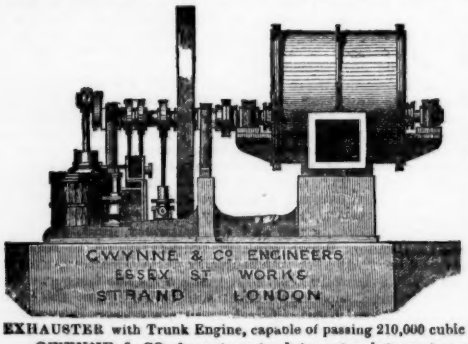
3190.—Westinghouse, G., jun., Southampton Buildings, London, "Improvements in apparatus for carburetting air so as to render it combustible as gas for lighting and heating purposes." Aug. 4, 1880.

Share List of Gas and Water Companies.

Number of Shares issued.	Amount per Share.	Name.	Amount paid up per Share.	Last Divd. p.Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount per Share.	Name.	Amount paid up per Share.	Last Divd. p.Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount per Share.	Name.	Amount paid up per Share.	Last Divd. p.Cent. p. Ann.	Latest Quotations.
	£	Gas Companies.	£ s. d	£ s. d	£		£	Gas Companies.	£ s. d	£ s. d	£		£	Gas Companies.	£ s. d	£ s. d	£
589944	10	Alliance and Dublin	10 0 0	10 0 0	17—17½	6200	5	Georgetown, Guiana	5 0 0	7 0 0	4¼—4¾	500000*l.*	Sk.	South Metropoltn.	100 0 0	11 15 0	203—208
10000	20	Anglo-Romano . .	20 0 0	10 0 0	21—23	300000	100	Glasgow Corporation Gas	100 0 0	9 0 0	205—210	1305000	Sk.	Do., "B" . . .	100 0 0	⁂	183—187
5000	20	Bahia (Limited). .	20 0 0	5 0 0	15½—16¼	115000	100	Do., do.	100 0 0	6 15 0	155—160	12000	5	Tottenham & Edmonton	5 0 0	10 0 0	9—10
1000	20	Do., 1st pref. . .	20 0 0	10 0 0	25—27		100	Grimsby Gas, A . .	100 0 0	..	186—190	2864	10	Do.	6 0 0	7 0 0	..
1500	20	Do., 2nd pref. . .	20 0 0	7 10 0	20—22	..	10	Hampton Court . .	10 0 0	10 0 0	15—16	1500	10	Wandsw. & Putney	10 0 0	10 0 0	14½—15
40000	5	Bombay (Limited).	5 0 0	7 10 0	6—6½	..	10	Hong Kong (Lim.)	10 0 0	10 0 0	15—16	1500	10	Do.	10 0 0	7 10 0	12½—13½
10000	5	Do., fourth issue.	4 0 0	7 0 0	½—1 pm.	7600	10	Hornsey	10 0 0	10 0 0	15—16	4000	10	Do.	10 0 0	7 0 0	11½—12
10000	10	Bournemouth . . .	10 0 0	8 0 0	13¾—14½	5000	10	Imperl. Continental	100 0 0	10p.c.& 2 p.c. bonus	192—196	26000	5	West Ham	5 0 0	10 0 0	8½—9½
..	..	Do., 5 per ct. pref.	100 0 0	5 0 0	95—100							..	10	West Kent	10 0 0	10 0 0	14—16
..	20	Do., D shares . .	18 0 0	9 0 0	6—8 pm.	..	..	Kingston	..	..	..	2400	5	Woolwich, Plmstd. and Charlton . .	5 0	16 0 0	9—10
5400	20	Brighton	20 0 0	10 0 0	35—37	..	..	Lea Bridge	..	7 0 0	11¼—12½						
5000	20	Brighton and Hove	20 0 0	10 0 0	34—36	56100*l.*	100	Liverpool United .	100 0 0	10 0 0	185—190						
14000	20	British (Limited) .	20 0 0	10 0 0	34—35	1691000*l.*	100	Do., B	100 0 0	7 0 0	125—135						
7282	20	Cagliari (Limited).	20 0 0	8 0 0	18—19	3865000*l.*	Sk.	London	100 0 0	10 0 0	183—188						
1500	10	Colney Hatch . . .	10 0 0	5 0 0	9—11	1500000*l.*	Sk.	Do., 1st pref. . .	100 0 0	6 0 0	127—132						
55000*l.*	Sk.	Commercial	100 0 0	11 5 0	188—193	7622	25	Do., A shares . .	25 0 0	6 0 0	31—33						
70000*l.*	Sk.	Do., 7 per cent. .	100 0 0	8 5 0	135—140	26692*l.*	Sk.	Do., Debenture stock	100 0 0	5*l.* & 6*l.*	..						
20000	20	Continental Union.	20 0 0	6 10 0	20½—21½			Malta and Mediterranean (Limited).	5 0 0	3 0 0	2¼—2¾						
20000	20	Do., new	14 0 0	6 10 0	par. 1pm	15000	5	Do., preference .	5 0 0	7 10 0	5—5½						
10000	20	Do., preference .	20 0 0	7 0 0	24½—25½			Mauritius (Limited)	2 5 0	1 0 0	1⅞—1¼ dis			Water Companies.			
750000*l.*	Sk.	Crystal Palace District	100 0 0	10 0 0	172—177	6000	5	Monte Video (Lim.)	20 0 0	6 0 0	16—17	615600	100	Chelsea	100 0 0	6 10 0	190—195
1250000*l.*	Sk.	Do., 7 per cent. .	100 0 0	7 0 0	125—130	25000	20	Nictheroy, Brazil (Limited)	10 0 0	5 0 0	5—6	1624700	100	East London . . .	100 0 0	6 10 0	200—205
500000*l.*	Sk.	Do., preference .	100 0 0	6 0 0	119—123	8000	10	Oriental (Calcutta).	5 0 0	9 0 0	7—7½	10798	50	Grand Junction .	50 0 0	5 0 0	108—113
25000	6	Do., ordin. 7 p. c.	1 4 0	7 0 0	⅜—1 pm.			Do., new shares .	4 0 0	9 0 0	1¼—1⅜pm	5840	25	Do., ½ shares . .	25 0 0	5 0 0	54—57
7100	25	Edinburgh	25 0 0	10 0 0	46—48	30000	5	Ottoman (Limited).	5 0 0	3 0 0	2¼—2¾	6160	25	Do., new ditto; max. div., 7½ p.c.	25 0 0	5 0 0	40—45
23406	10	European (Limited)	10 0 0	10 10 0	19½—20½	30000	5	Do., new shares .	4 0 0	9 0 0	1¼—1⅜pm						
12000	10	Do., new shares.	7 10 0	10 10 0	6½—7½	10000	5	Ottoman (Limited).	5 0 0	3 0 0	2¼—2¾						
35406	10	Do., new shares .	5 0 0	10 10 0	4—5 pm.	10000	10	Pará (Limited) . .	10 0 0	5 0 0	6—6½	5551805*l.*	100	Kent	100 0 0	8 0 0	280—290
4696300*l.*	Sk.	Gaslight & Coke A.	100 0 0	11 5 0	182—185	3000	10	Richmond (Surrey)	10 0 0	10 0 0	17—17½	781800*l.*	100	Lambeth	100 0 0	6 10 0	190—195
1000000*l.*	Sk.	Do. B.	100 0 0	4 0 0	75—78	3000	10	Do., new	10 0 0	9 0 0	..	3261505*l.*	100	Do., max., 7½ p.c.	100 0 0	6 10 0	160—170
50000	10	Do. do., 5th do. .	10 0 0	5 0 0	17½—18	37500	20	Rio de Janeiro (Limited)	20 0 0	10 0 0	26—28	442	100	New River	100 0 0	10 3 8	375—385
2000000*l.*	Sk.	Do. C 10 p.c. pref.	100 0 0	10 0 0	217—222							4475	100	Do.	85 0 0	10 3 8	290—300
3000000*l.*	,,	Do. D do. do.	100 0 0	10 0 0	217—222	1500	32½	Shanghai	32 10 0	12 0 0	..	400000	100	Do., deb. sk., 4p.c.	100 0 0	4 0 0	105—107
1650000*l.*	,,	Do. E do. do. .	100 0 0	10 0 0	217—222	135000	100	Sheffield, A	100 0 0	10 0 0	197 - 198	6668000*l.*	100	Southwrk & Vauxh.	100 0 0	6 0 0	198—203
300000*l.*	,,	Do. F 5 do. do. .	100 0 0	5 0 0	108—111	99700	100	Do., C	100 0 0	10 0 0	195—197	3247000*l.*	100	Do., pref. stock.	100 0 0	5 0 0	128—131
600000*l.*	,,	Do. G 7½ do. do. .	100 0 0	7 10 0	160—165	12500	5	Singapore (Lim.) .	5 0 0	7 10 0	6—6½	1265000*l.*	100	Do., D shares. .	100 0 0	6 0 0	165—170
1300000*l.*	,,	Do. H	100 0 0	7 0 0	136—139	2000	5	Do., preference .	5 0 0	7 10 0	5¾—6¼	15073	61	West Middlesex .	61 0 0	6*l.* p.sh.	180—185

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

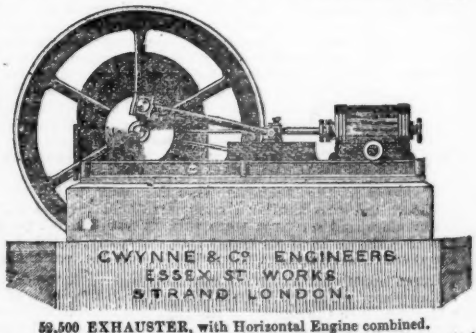
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, **GWYNNE & CO.**, Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.

WANTED, Readers of a Pamphlet, prepared for Gas Companies to distribute to Gas Consumers—"Cooking & Heating by Gas;" on Burners, &c.
Copies, by post, Threepence, direct from the Author, MAGNUS OHREN, Assoc.M.I.C.E., Gas-Works, SYDENHAM.

WANTED, by the Advertiser, a Young Man, aged 27, an Engagement in a Gas Company's Office, Assistant Engineer, or Clerk of Works, &c., has had every experience in a Gas-Works. First-class testimonials and references.
Address No. 695, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Young Man (married), a Situation in a Gas-Works. Is the son of a Manager, and is a good Main and Service Layer. Can do any Fittings in the Retort-House; also can Fix and Read Indexes of Meters, and has had experience both at Lathe and Vice. Very steady.
Apply to the MANAGER, Gas-Works, Crayford, KENT.

WANTED.—The Advertiser, a Young Man, aged 39, married, is open for an Engagement as MANAGER and SECRETARY of a medium-sized Gas-Works, or SUB-MANAGER of a large Works. Has a thorough Knowledge of the Manufacture and Distribution of Gas in all its branches, having had sole management of Gas-Works for 16 years. Highest testimonials and references.
Address No. 678, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ADVERTISER, aged 21, is desirous of an Engagement on Gas-Works. Can Read and Fix Meters; has had good experience of the Lathe, and is willing to be generally useful.
Address R. C., care of Messrs. Willey and Co., Gas Engineers, EXETER.

ADVERTISER, aged 24, seeks an Appointment in a Gas-Works or Engineer's Office. Well up in all details of Gas. Fair draughtsman, good writer, and quick at figures. Salary moderate. Total abstainer.
Address No. 697, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by an established Foreign (European) Gas Company, a RESIDENT ENGINEER, who must be experienced in the Management of Gas-Works, and well versed in the details of the Manufacture and Distribution of Gas and Treatment of Residual Products according to the most recent and approved methods. Salary and commission from £350 to £500 per annum, according to qualifications.
Applications, with testimonials, to be addressed to ENGINEER, care of Messrs. WATERLOW AND SONS, 49, Parliament Street, WESTMINSTER, S.W., on or before Nov. 15.

CITY OF LIVERPOOL—CITY ENGINEER'S DEPARTMENT.

GAS-METER TESTER, &c.

WANTED, in the Office of the Gas and Meter Inspector, a person to Test Gas-Meters. A Gas-Fitter or Meter-Maker preferred. Wages 35s. per week.
A list of duties can be obtained on application at the City Engineer's Office, Liverpool, W.
Applications, in candidate's handwriting, endorsed "Gas-Meter Tester," stating age, qualifications, and previous experience, with copies of testimonials, to be sent to the City Engineer, Liverpool, W., not later than Nov. 12, 1880.

By order,
JOSEPH RAYNER, Town Clerk.
Municipal Offices, Liverpool, Nov. 1, 1880.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS REPORTS for 1869, 1870, and 1876.

THE Institution of Civil Engineers re- quire the above-named reports in order to complete their set.
Any one, having copies to spare of any or all of the three, will oblige by communicating with the Secretary of the Institution,

JAMES FORREST.
25, Great George Street, Westminster, S.W.

WANTED, to Lease Gas-Works.
Highest References.
Apply, by letter, to No. 686, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE.—A Purifier, 10 ft. square, 5 ft. deep, 10-in. Inlet and Outlet.
One 10-in. Centre-Valve for working four purifiers.
Two 6 ft. by 5 ft. Circular Cylinders.
One Lifting Screw for Purifier Lids.
A Condenser complete, with cast-iron Boxes, a double row of 10-in. Pipes, 8 in. each row, and about 28 ft. high, with 10 in. Inlet and Outlet, Connections, and Bye-pass, and three 10 in. Valves.
All the above are in capital condition. Also a quantity of Old Iron.
For further particulars, apply at the Gas-Works, Bromley, KENT.

THE Gloucester Gas Company have the undermentioned APPARATUS for Sale:—
About 150 feet of D-shape Wrought-Iron Hydraulic Main, size 19 in. by 19 in. Also about 38 ft. of D-shaped Wrought-Iron Hydraulic Main, size 20 in. by 20 in. Annular Condenser, consisting of six Vertical Pipes, 24 in. diameter, 19 ft. high, with three 12-in. Slide-Valves and 12-in. Connections.
Scrubber (round), 5 ft. by 20 ft., with three 12-in. Slide-Valves, and 12-in. Connections.
Exhauster (Jones) to pass about 15,000 feet per hour.
Exhauster (Beales) to pass about 25,000 feet per hour.
Two Vertical Steam-Engines, each about 6-horse power, with Pulleys, and Shafting used for driving the above.
Boiler 14 ft. 6 in. by 3 ft. 6 in., with Centre Tube, and four Galloway Patent Tubes.
4-horse power Horizontal Steam-Engine.
Two Purifiers, 16 ft. by 8 ft., with six 12-in. Slide-Valves and 12-in. Connections.
Gasholder, Double Lift, with Cast-Iron Tank, capacity 37,000 feet.
Gasholder, Double Lift, capacity 100,000 feet.
Gasholder, Double Lift, capacity 240,000 feet.
One 12-in. Governor, by Wright, London, with 12-in. Valves, Bye-Pass, and Connections.
Two 12-in. four-way faced Valves, by Cockey.
For further information, &c., apply to the undersigned.
R. MORLAND, Engineer.

TENDERS are invited, accompanied with designs and specifications for a GASHOLDER-TANK, 70 ft. diameter and 18 ft. deep, with TELESCOPIC HOLDER for the same.
Full particulars may be obtained on application to EDWIN A. WRIGHT, Secretary, Brecon Gas Company.

BOROUGH OF SALFORD.

SPENT OXIDE.

THE Gas Committee of the Salford Cor- poration invite OFFERS for the Purchase of about 500 Tons of SPENT OXIDE now in use at the Regent Road Gas Station.
Full particulars and forms of tender may be obtained on application to the Engineer.
Tenders to be delivered to me on or before the 9th of November.

By order,
CHRIS. MOORHOUSE, Town Clerk.
Town Hall, Salford, Oct. 29, 1880.

TO CHEMICAL MANUFACTURERS, TAR DISTILLERS, AND OTHERS.

THE Directors of the Shipley Gaslight Company are prepared to receive TENDERS for the Purchase of their surplus TAR and AMMONIACAL LIQUOR for One year, from Jan. 1, 1881.
The Company will load f.o.b. the Leeds and Liverpool Canal, at Shipley, or into the Contractor's carts at the Works.
The quantity of coal carbonized in twelve months is about 8000 tons.
Any further information can be had on application to the Manager.
Sealed tenders (stating separately price per ton for Tar and Liquor, and endorsed "Tender for Tar, &c.") to be sent in on or before Nov. 9, 1880.

JNO. WILCOCK, Manager.
Gas-Works, Shipley, Oct. 23, 1880.

GAS-WORKS FOR SALE.

TO BE SOLD by PUBLIC AUCTION, at the Mart, Rosemary Street, Belfast, on FRIDAY, the 12th of November, at One o'clock,

THE Gas-Works of Tandragee, an im- proving MARKET and MANUFACTURING Town in County Armagh, and within one mile and a half of CANAL and RAILWAY service from the seaports of BELFAST and NEWRY, accessible within an HOUR.
The Concern comprises all the Ground, Buildings, and Plant requisite for present make and further extension, including Dwelling-house and Shop at street frontage, Retort-House with four benches of Retorts, Coal-Stores, Condensers, Purifiers, Station-Meter, Gasometer, Governors, Tar-Well, Pump, Street-Mains, Consumers Meters, &c., &c.
The present GAS-RENTAL of £700 per annum can be largely increased.
The premises are held under FEE-FARM GRANT at an annual rent of £10.
Nine perches of adjoining Land have been added to the Premises, and are held for lives renewable for ever, FREE OF RENT.
If so desired, a portion of the purchase-money may remain as a first charge on the Property.
Intending Purchasers can make inspection any day previous to sale, and, for further particulars, may apply to
ALEXANDER MILNE & Co., 11, CHICHESTER ST.
And for Title to
R. A. MACRORY, Solicitor, ULSTER CHAMBERS.
HUGH C. CLARKE & SON, Auctioneers, Rosemary Street, BELFAST.
Oct. 15, 1880.

RETORTS, &c.

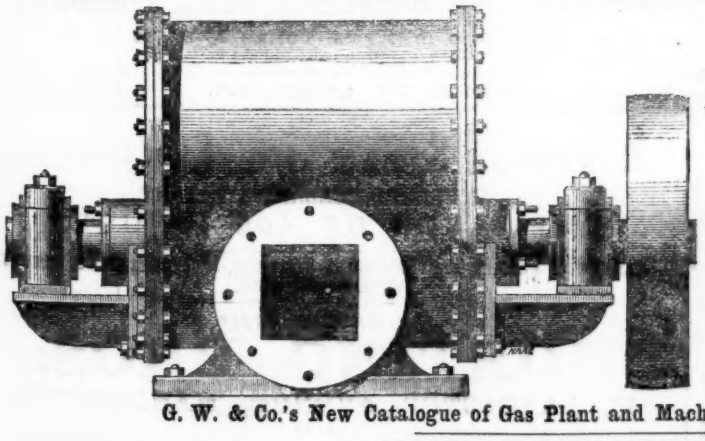
THE Directors of the Rochester, Chat- ham, and Strood Gaslight Company are prepared to receive TENDERS for the Supply of 1100 ft. run of CLAY RETORTS, 45,000 BRICKS, and 40 Tons of CLAY, according to specification and form of tender, which may be had on application at their Office, 58, High Street, Rochester.

By order,
WILLIAM SYMS, Secretary.
Rochester, Oct. 27, 1880.

THE LONDON SULPHUR COMPANY, LIMITED.
Registered under the Companies Acts, 1862 to 1880.
Capital £20,000, in 4000 Shares of £5 each.

THIS Company has been formed for the purpose of working a process (protected by Royal Letters Patent) by which Sulphur, almost equal in quality to refined brimstone, is extracted by means of superheated steam from "spent" oxide of iron and other similar materials used by the Gas Companies after their purifying powers have been exhausted in cleansing gas from sulphur; and the hydrated oxide is by this process at the same time renovated and recovered in the best condition for being used over again in the gas purifiers.
The London Sulphur Company has tested the process practically by the erection of nine large retorts, or steam chambers, holding at each charge rather more than 1 ton of spent oxide; and, having thus demonstrated its capability of yielding large returns, is now prepared to receive APPLICATIONS FOR SHARES, with the view of extending the works by the further construction of 50 steam chambers of a capacity to make 2000 tons of sulphur per annum.
From 8000 to 10,000 tons of spent oxide, containing from 40 to 50 per cent. of free sulphur, accumulate annually in the gas-works of London alone, and are disposed of, almost as a waste product, at about £1 per ton, mainly for use in the manufacture of artificial manure; but the sulphur which is extracted by this Company's process is worth from £7 to £9 per ton—and each ton of spent oxide, after extraction of the sulphur, leaves about half a ton of residue, which is hydrated oxide of iron, with all its original power as a purifier of gas restored, and worth £2 per ton.
Spent oxide of iron contains double the percentage of free sulphur which is contained in the richest, and four times as much as in ordinary Silician brimstone ores, while the residual oxide almost repays the first cost of the raw material; so that the gas-works of London may be regarded as the most valuable brimstone mines in the world—and it is no small advantage that they are close at hand, instead of in a foreign country a thousand miles away.
Full prospectus, with the last report of the Managing Director of the Company, who estimates the profits at 28 per cent. per annum, and other particulars, may be had by intending Shareholders, on application to the Secretary, F. H. PETERS, Esq., 4, Victoria Street, WESTMINSTER, S.W.

BEALE'S IMPROVED PATENT GAS EXHAUSTERS,



WITH OR WITHOUT
WROUGHT-IRON SPINDLES AND
ENGINES COMBINED.

GEORGE WALLER & CO.,
MAKERS OF
ENGINES, EXHAUSTERS,
INDEX AND DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, AND OTHER PUMPS,
SCRUBBERS AND PURIFIERS,
CONDENSERS, BOILERS, &c.

G. W. & Co.'s New Catalogue of Gas Plant and Machinery can be had on application.

PHŒNIX ENGINEERING WORKS:
HOLLAND STREET, SOUTHWARK, S.E.

MR. W. H ALLEN begs to advise the public that he has resigned the appointment he has held for the past twelve years, as Manager to the firm of Messrs. Gwynne and Co., the Hydraulic and Mechanical Engineers, of Essex Street Works, Victoria Embankment, London; and has taken the Engineering Works lately occupied by Messrs. Merryweather and Sons, in York Street, Lambeth (who have removed to larger premises at Greenwich), where he has commenced business as a manufacturer of Special Machinery of the best London make.

He has taken into partnership Mr. Richard Wright, who occupied a position under him for many years at the above works.

The style of the firm will be W. H Allen and Co.
York Street Works, Lambeth, S.E., Nov. 1, 1880.

TAR CONTRACT.

THE South Metropolitan Gas Company invite TENDERS for the Surplus TAR, about 700,000 gallons, from their Rotherhithe Station for the year 1881.

Particulars may be obtained on application to the undersigned.

Tenders to be sent in by Wednesday, Nov. 17.

By order of the Board,
GEORGE LIVESEY, Secretary and Engineer.
Nov. 1, 1880.

TO TAR DISTILLERS.

THE Buxton Local Board invite Tenders for the Purchase of their Surplus TAR and AMMONIACAL LIQUOR for One, Two, or Three years, to be delivered into Contractor's tanks and weighed on the machine on the Works in Ashwood Dale.

Any other particulars may be obtained on application to Mr. Geo. Smedley, Gas Offices, Buxton.

Tenders, endorsed "Tender for Tar, &c." addressed to the Chairman of the Gas Committee, to be delivered not later than the 4 h of November next.

JOSIAH TAYLOR, Clerk to the Board.
Buxton, Oct. 21, 1880.

MALTA.

LIGHTING BY GAS VALLETTA, FLORIANA, MARSA, SENGLEA, COSPICUA, & VITTORISSA.

SEALED Tenders will be received at this Office until noon of Monday, June 3, 1881, for Lighting by Gas the Streets of Valletta, Floriana, Marsa, Senglea, Cospicua, and Vittorissa, for a period of Ten years, to date from May 15, 1882.

Tenders to be on the established printed form supplied by this Office.

The conditions of the contract and further particulars will be made known on application to this Office.

Each tender is to be accompanied with a deposit of £200, which sum is to be temporarily lodged with the Receiver-General, to be dealt with as stated hereunder; and no notice will be taken of any tender unless the due fulfilment of this condition be found endorsed thereon by that Officer.

The deposit thus made shall be forfeited in favour of Government should the party tendering, or the surety, fail to appear for the stipulation of the requisite contract in the event of the tender being accepted, within three days from the day of the notice given to him to that effect.

The deposits of the unsuccessful tenderers shall be returned to them immediately after notice will have been given to the party whose tender will have been accepted.

Any notarial fees will have to be paid by the Contractor.

The undersigned retains the power of accepting or rejecting all or any of the tenders received.

C. RAPINET,
Acting Auditor-General and
Director of Contracts.
Office of the Auditor-General and Director of Contracts, Valletta, Oct. 7, 1880.

GARSIDE'S IMPROVED MAIN DRILLING CLIP.

No. 1 takes from 2-in. to 6-in. Mains.
No. 2 takes from 6-in. to 12-in. Mains.

GARSIDE'S REGISTERED TUBE-VICE takes ⅝ brass to a 2-in. Socket.

May be had direct from the maker, SAMUEL GARSIDE, Gatefield Iron-Works, ASHTON-UNDER-LYNE.

BLACKBURN CORPORATION GAS DEPARTMENT.

EXHIBITION OF GAS OVENS, STOVES, ENGINES, BURNERS, AND OTHER APPLIANCES AND INVENTIONS FOR THE ECONOMIC USE OF GAS FOR DOMESTIC AND MANUFACTURING PURPOSES.

THE Gas Committee of the Blackburn Corporation have determined to hold an Exhibition as above stated in the

ASSEMBLY ROOMS, TOWN HALL, BLACKBURN,

To commence on the 10th of November, and continue for Twelve Days.

Any information required may be obtained from the undersigned,

S. R. OGDEN, Engineer and Manager.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street, WESTMINSTER.

MR. CORBET WOODALL, C.E.,

Has Removed his Office to

PALACE CHAMBERS, BRIDGE STREET,

WESTMINSTER, S.W.

NOTICE OF REMOVAL.

THE OWNERS OF
THE
BIRTLEY IRON-WORKS
AND
PELAW MAIN COLLIERIES

Have REMOVED their London OFFICES from No. 101, Cannon Street, to No. 46, Cannon Street.

Their Warehouse for Gas and Water Pipes and other Castings is at Scott's Wharf, Bankside, SOUTHWARK.

Price 28s. each, handsomely bound in Morocco, cloth sides, gilt edged and lettered.

THE FIRST AND SECOND VOLUMES

OF

KING'S TREATISE

On the Science and Practice of the Manufacture and Distribution of

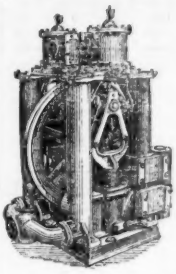
COAL GAS.

Edited by THOS. NEWBIGGING, C.E., M.Inst.C.E. and W. T. FEWTRELL, F.C.S.

Orders received by

WALTER KING, 11, Bolt Court, Fleet Street, London, E.C.

John Cameron's Specialities



ARE HIS
PATENT LEVER
PUNCHING MACHINES
AND HIS
STEAM-PUMPS
FOR
GAS-WORKS,
Feeding Boilers, Steam Fire-Engines, Colliery Deep Lifts, Irrigation, Contractors, and Chemical purposes.

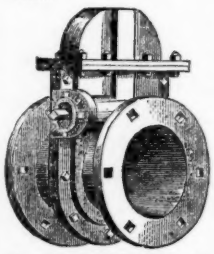
WORKS:
OLDFIELD ROAD, SALFORD, MANCHESTER.

H. & C. DAVIS & CO.'S
Illustrated Catalogue sent Free.

FAMILY
GAS KITCHENERS,
HOTEL
GAS RANGES,
ARTIZANS & COTTAGE
GAS COOKERS,
BREAKFAST
GRILLERS, &c.
GAS BATHS,
CIRCULATING GAS
BOILERS,
ASBESTOS FIRES, AND
CHEERFUL
HEATING STOVES.

286, 288, & 290, CAMBERWELL ROAD, LONDON, S.E.

B. DONKIN & CO.'S
IMPROVED GAS-VALVES
WITH WROUGHT-IRON PINIONS.



These Valves are proved on both sides to 30 lbs. on the square inch before leaving the works, and are kept in stock.

In ordering Valves, please state whether required for under or above ground, and if to be with flanges or spigots and sockets cast on, or with separate spigot and socket pieces.

Also Sole Makers of
J. BEALE'S NEW PATENT GAS EXHAUSTERS,
and Makers of
STEAM-ENGINES FOR DRIVING GAS EXHAUSTERS,
VALVES FOR AMMONIACAL LIQUOR,
IMPROVED BRIDGE VALVES FOR REGULATING THE SEAL IN HYDRAULIC MAINS,
BYE PASS VALVES, SCREW WATER-VALVES, &c.

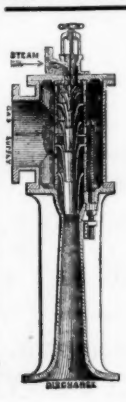
B. DONKIN & CO., BERMONDSEY, LONDON, S.E.

ANTI-CORRODO TUBES
(BARFF'S RUSTLESS PROCESS)

See Professor FOSTER'S *Article on "The Corrosion of Iron" in* JOURNAL *of March* 30, 1880.

THE RUSTLESS AND GENERAL IRON COMPANY
(JAMES E. AND SAMUEL SPENCER),
Makers of ANTI-CORRODO (BARFF'S) TUBES AND FITTINGS
For Gas, Steam, and Water; also Black Galvanized and Enamelled.

WORKS: West Bromwich.
Quotations and Pamphlet on application to
97, CANNON STREET, LONDON, E.C.
LIVERPOOL OFFICE: 34, Moorfields.



KÖRTING'S STEAM-JET EXHAUSTER,
IMPROVED CLELAND'S PATENT.
UPWARDS OF 400 IN USE.

CLELAND'S PATENT SLOW-SPEED CONDENSER, AND CLELAND'S PATENT STEAM SCRUBBER.

FOR PARTICULARS, APPLY TO

KÖRTING BROS.,
17, LANCASTER AVENUE, MANCHESTER,
OR TO
GERALD J. TUPP, Creek Engine-Works, Middle Mall, Hammersmith, London, W.

"SYSTEMATIC WATERING."

THE ordinary Wet Meter can only register correctly at one water-line, and varies at every other.

This fact is recognized in "Compensating" Meters, which are simply ordinary Meters with superadded contrivances, more or less complicated, to maintain as nearly as possible that one water-line at which alone correct registration can take place.

With the use of the ordinary Wet Meter comes anxiety that the "systematic watering" be carefully performed; but who can be assured of this in every case? And even if such assurance were possible, evaporation could not by any system of periodical watering be prevented.

The use of "Compensating" Meters does not get rid of this anxiety, but merely transfers it to the question of the reliability of various kinds of additional mechanism (very liable to get out of order), in which experience has abundantly proved no confidence can long be placed.

There is no room for any anxiety in using the Warner and Cowan Meter, because it registers with practically the same accuracy at all heights of the water-line; therefore, careless watering can never affect its registration, nor is there any extraneous mechanism to become deranged.

The Warner and Cowan Meter is as simple as the ordinary Wet Meter, its measuring-chamber being a metal cylinder of precisely the same construction, but with a smaller similar one forming part of it to prevent its discharging (at reduced water-levels, as ordinary meters do) more gas to the burners than the revolutions record on the index.

But beyond this, the Warner and Cowan Meter possesses the additional advantage of a greater range of water-line than the ordinary Wet Meter.

It has been shown that variation of the level can only be prevented by special additional arrangements and mechanism (all liable to go wrong), and that in the absence or failure of these contrivances, variation is sure to occur, and this the Sale of Gas Acts allow to the extent of 5 per cent.

But no such range of error is required (or is possible) in the Warner and Cowan Meter, changes of water-line neither affecting it nor requiring to be provided against. The range of float is therefore greater, and the necessity for watering less frequent, than in other Meters; and, when performed, is only for the purpose of keeping open the valve for the supply of gas, and has no practical effect on its measurement.

W. & B. COWAN,

(ESTABLISHED 1827,)

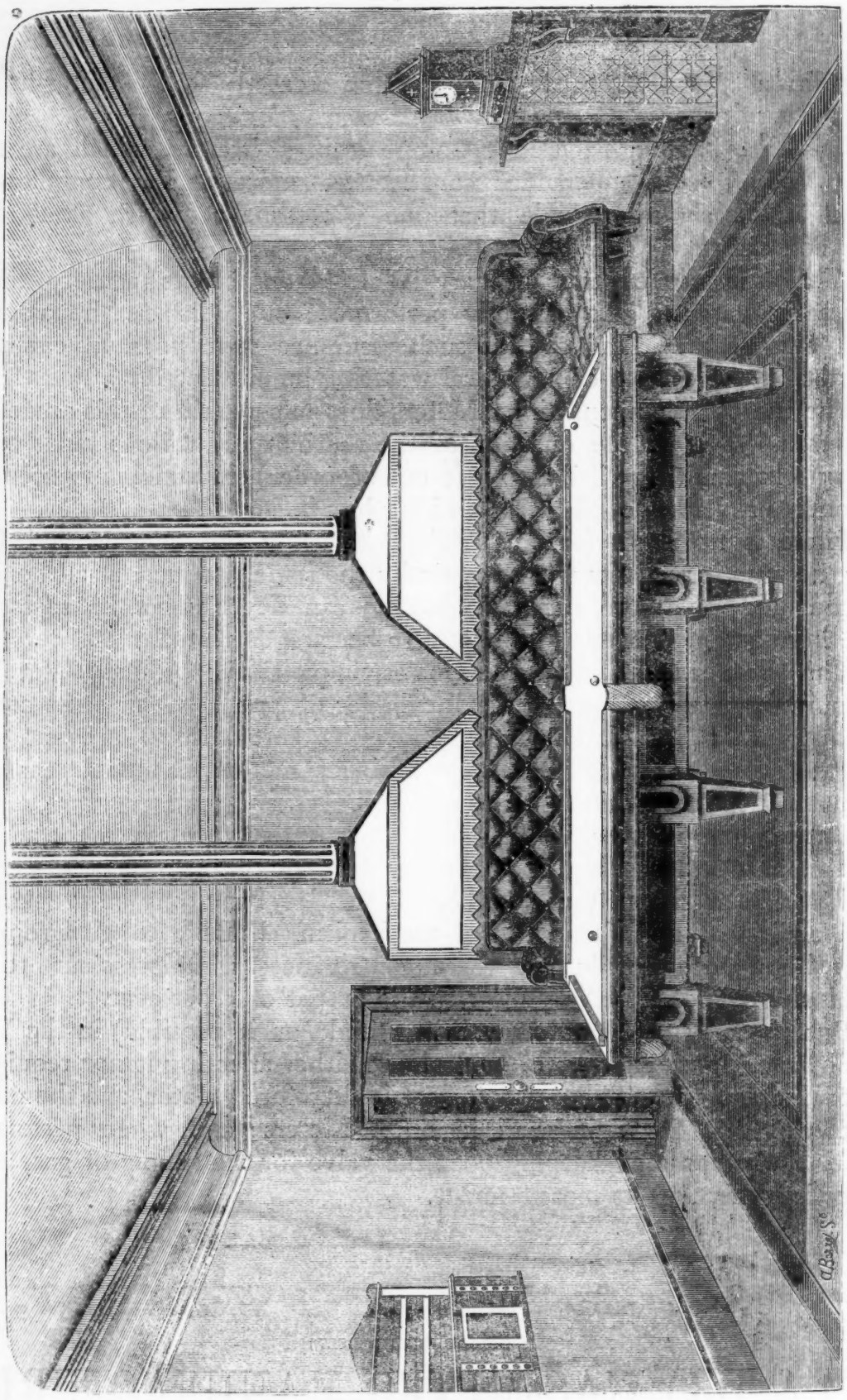
WET & DRY GAS-METER MANUFACTURERS,

CHURCH ST., MILLBANK ST., *LONDON, S.W.* | DUTTON ST., NEW BRIDGE ST., *MANCHESTER* | BUCCLEUCH ST. WORKS, *EDINBURGH.*

THE LATEST NOVELTY

FOR THE EFFECTIVE LIGHTING of BILLIARD TABLES.

BILLIARD TABLE LIGHTING BY WILLIAM SUGG'S PATENT SELF-VENTILATING SYSTEM AND BURNERS OF HIGH ILLUMINATING POWER,



Securing a Total Absence of Heat and Shadow, with a Steady and Brilliantly White Light, and Small Consumption of Gas.

N.B.—All products of combustion are carried away into the open air, and cannot, therefore, mix with and vitiate the atmosphere of the room.

One of the above has been fitted up in the Billiard-Room of the Raleigh Club, Regent Street, and the Secretary states that the Table is the best lighted he has ever seen.

APPLY TO

WILLIAM SUGG,

VINCENT WORKS, WESTMINSTER, & GRAND HOTEL BUILDINGS, CHARING CROSS.

SAMUEL CUTLER & SONS,

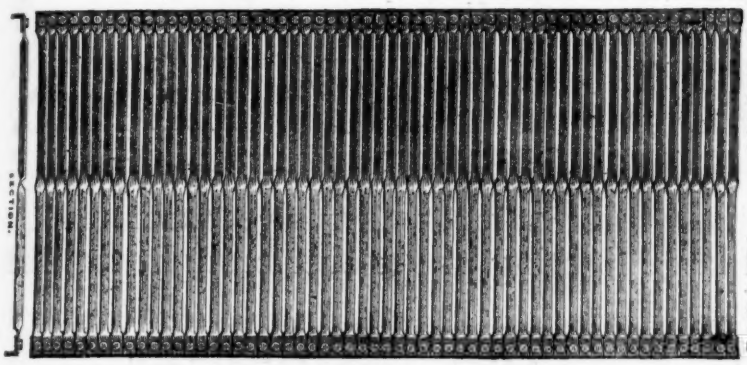
MILLWALL, LONDON, E.,

CONTRACTORS FOR THE

ERECTION OF GAS AND WATER WORKS,

Undertake their ENTIRE ERECTION or EXTENSION in any part of the World, including Small Works for VILLAGES and MANSIONS, as well as of very LARGE EXTENT. Have recently constructed for the PHŒNIX GAS COMPANY the LARGEST GASHOLDER yet erected.

S. C. and SONS supply *every* requisite for Gas-Works, and keep in stock Small Articles, such as BARROWS, SCOOPS, RETORT-LIDS, BOLTS, &c.; and they manufacture WOOD SIEVES of a very superior description.



CUTLER'S PATENT WATER-VALVES

Are the very best possible as PURIFIER VALVES; leakage impossible, most easy to work, never get out of order or the worse for wear, and can, if desired, be very simply arranged to work the whole or a part of a set of Purifiers in any conceivable order whatever. Have already been erected and approved at the London Gas-Works, Nine Elms; Phœnix Gas-Works, Greenwich; Maidstone, Ipswich, &c.

Full Particulars on Application.

CUTLER'S PATENT SIEVES

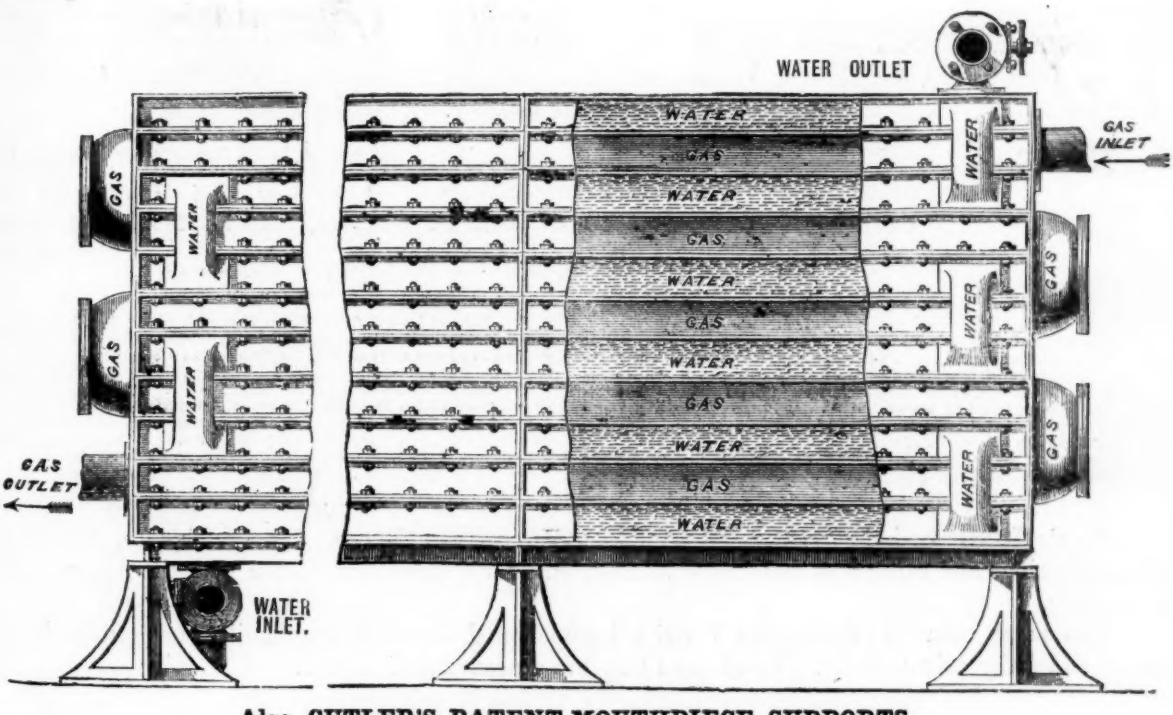
Are the most durable. The sieve bars presenting an inclined plane to the flow of the Gas, offer the least possible resistance, greatly reducing pressure, and permitting contact with every part of the purifying material. Have been supplied to many of the London and Provincial Gas-Works, and give great satisfaction.

Copies of Testimonials on Application.

MORRIS AND CUTLER'S PATENT CONDENSERS

Adopt water as a cooling medium, the respective streams flowing in opposite directions; quantity of water required but small, and being only raised in temperature, is useful for any purpose of the works. The power of Condensers can be regulated at will by the amount of water permitted to pass through. Erected and giving great satisfaction at Brentford, Tunbridge Wells, Maidstone, Buxton, Phœnix Gas-Works, Greenwich; where its advantages may be seen.

Mr. WATES, of Greenwich, has kindly offered to reply to any inquiries addressed to him as to its efficiency.



Also CUTLER'S PATENT MOUTHPIECE SUPPORTS,

AND

CUTLER'S PATENT REMOVABLE DIPS.

[*See* JOURNAL for Nov. 25, 1879.]

The understated declaration with which we introduced our apparatus when the Argand system was in the full tide of its fame, has been fully borne out by general experience, namely—

"THE FLAT-FLAME IS THE ONLY PRACTICABLE SYSTEM FOR STREET LIGHTING; and, 'in actual use,' yields as much light with Common Gas, and more with Cannel Gas, than any Argand System."

CHARLES HUNT, Esq. (President of the British Association of Gas Managers), in his Inaugural Address to the members at their annual meeting, held in London, June, 1880, said: "Rivalry has stimulated into being, for outdoor purposes mainly, Burners of large power, that have fully maintained the superiority of coal gas over the electric light. To Mr. Bray our thanks are due for his development of the **FLAT-FLAME BURNER** into a lighting medium of a very high order, *and for his vindication of its claims to practical consideration.*"

The above declaration was received with marked applause by the crowded meeting.

BIRMINGHAM LAMP TESTS.

AFTER the most exhaustive series of experiments, extending over more than twelve months, with the most extensive assortment of Burners and Lanterns of large lighting power ever brought together, the Birmingham Authorities have

ADOPTED BRAY'S SYSTEM

for their Street-Lighting Improvements, for which purpose Sixty-Five 100-candles power Lanterns of medium lighting power are being fixed.

The apparatus used in the above tests were all of our usual medium lighting power class, and the tests showed that we sacrifice a considerable amount of lighting power for general efficiency. The tests further showed that our 80*-candles* HIGHEST *lighting power burner yielded* 3·51 *candles per foot of gas—the quality being* 16·75 *candles* (3·35 *per foot*) *by the standard—which was a higher result than that yielded by any other flat-flame burner, though copies of our Slit-Unions, enlarged and improved by us Jan.,* 1879, *were used by our competitor; and higher than the* 80*-candles power Argands.*

NOTE.—The above is the most conclusive answer to the ever-changing and misleading statements which are being made by our competitor, with the object of taking from us the honours we have secured in open contest.

Extract from the *Leeds Mercury*, April 1, 1880.

At the meeting of the Leeds Town Council, March 31, Alderman Gaunt moved that the Council approve of the acceptance by the Corporate Property Committee of the tender of Messrs. Geo. Bray and Co. for the supply of 21 new lamps, to be placed upon the pillars round the Town Hall. The Committee had tested Sugg's and other lamps, and found Messrs. Bray's the best. It was intended to have two 200-candles power and two 100-candles power, and 17 round the hall of 80-candles power. Mr. Lynd, in seconding the motion, said that he had had an opportunity of seeing different lamps tested at Birmingham, and he was in favour of Messrs. Bray's.

Extract from the *Daily Free Press*, Aberdeen, Jan. 1, 1880.

Judging of the merits of the lights as they appeared last night, on-lookers seemed to be generally of opinion that between Sugg's patent and Bray's larger light at the corner of Union Buildings, Castle Street, there was no perceptible difference in the illuminating power. When the vital question of gas consumption is taken into account, it is found that in the Castle Street lamps there is a marked difference in the quantity of gas consumed, for while 30 feet of gas are hourly burned in Sugg's Patent Lamp, only 20 feet are used by Bray's Lamp during the same period.

[The above Lamps have Meters attached.]

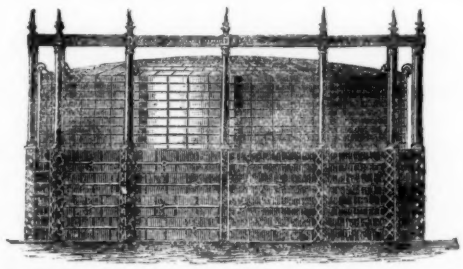
BRAY'S LANTERNS have been adopted by the Vestry of St. George, Hanover Square, London, for all the crossings and refuges of that important district, after a direct competition with the Argand system of lighting.

Also more than 50 Towns and Vestries have adopted them, after a similar competition in most cases; and many private users. In all cases they are a pronounced success.

GEORGE BRAY & CO., BLACKMAN LANE, LEEDS.

June, 1880.

THE
THAMES BANK IRON COMPANY,
UPPER GROUND STREET, LONDON, S.E.,
SUPPLY FROM STOCK
CAST-IRON RETORTS AND ALL KINDS OF GAS-WORKS APPARATUS,
SOCKET-PIPES FOR GAS OR WATER PURPOSES,
FLANGE-PIPES FOR STEAM,
RAIN-WATER PIPES AND GUTTERS,
HOT-WATER BOILERS, PIPES, AND CONNECTIONS,
LAMP-COLUMNS, LAMPS, LAMP-FRAMES, WROUGHT TUBES, &c.,
HOT WATER AND HOT AIR APPARATUS,
Erected complete on the most Improved Principles.



HENRY BALFOUR & CO.,
ENGINEERS, IRONFOUNDERS, AND GAS APPARATUS MAKERS,
39, FINSBURY CIRCUS, LONDON, E.C.
Works: DURIE FOUNDRY, LEVEN, FIFE, N.B.
MANUFACTURERS OF
GASHOLDERS, SINGLE OR TELESCOPE, WITH OR WITHOUT COUNTERBALANCE GEAR; TANKS, CAST & WROUGHT IRON.
BOILERS, CONDENSERS, CRANES, EXHAUSTERS AND ENGINES,
GIRDERS (Cast and Wrought Iron), IRON PIPES, PUMPS, PURIFIERS, RETORTS & FITTINGS,
ROOFS, SCRUBBERS, SHAFTING, VALVES, WASHERS.
ANDERSON'S PATENTED INVENTIONS, VIZ.—
FOUR-WAY BYE-PASS VALVES, ENGINES AND EXHAUSTERS, REVOLVING BRUSH SCRUBBERS, GAS-WASHERS, FUEL-MAKING MACHINES, GOVERNORS, &c.
H. B. & Co. undertake Contracts for the Supply and Erection of Gas-Works, either for Towns or Mansions, or the Remodelling of existing Works.
SHIPPING ORDERS receive special attention.
H. B. & Co. having had large experience in this Department, undertake to ship, f.o.b., properly packed and marked for export.
ESTIMATES AND DESIGNS ON APPLICATION.

WOOD
TROUGHING
For Preserving Service-Pipes.
Price from Three-Farthings per Foot,
In any Lengths.
THOS. PROUD,
Brookfield Works, Icknield St., Birmingham.

THE
SILICA FIRE-BRICK CO.,
OUGHTIBRIDGE
Near SHEFFIELD,
Manufacturers of THE ORIGINAL SILICA OR DINAS FIRE-BRICKS. Specially adapted for Gas-Retort Furnaces and for Siemens's Gas-Furnaces. Shipments promptly executed to London, Liverpool, Hull, Grimsby, &c.

W. C. HOLMES & Co.,
ENGINEERS AND CONTRACTORS
FOR
GAS AND WATER-WORKS,
WHITESTONE IRON-WORKS,
HUDDERSFIELD.

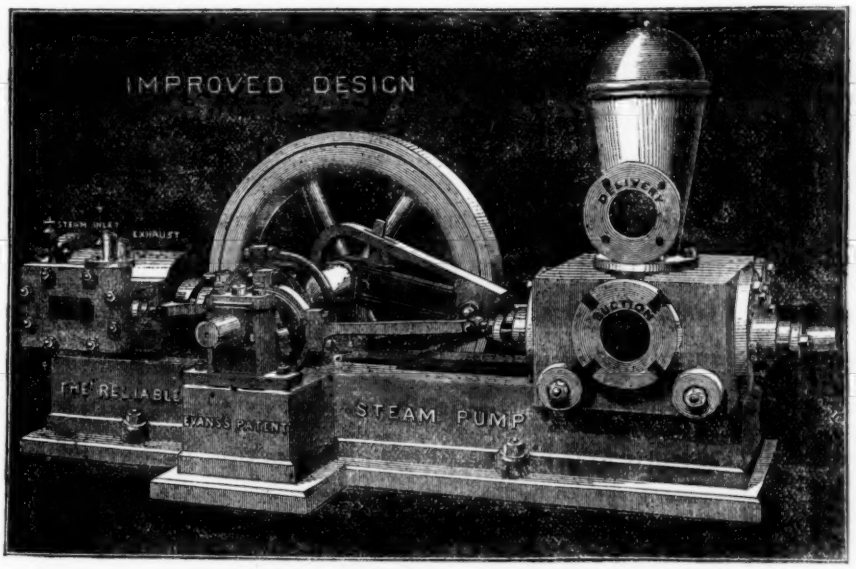
REFERENCES TO UPWARDS OF 400 WORKS.

E. & W. H. HALEY,
IRONFOUNDERS & MAKERS OF
CAST-IRON PIPES
FOR
GAS, WATER, & STEAM.

LISTER HILLS FOUNDRY,
BRADFORD, YORKSHIRE.

THE "RELIABLE"
IS
THE PUMP FOR TAR AND THICK FLUIDS.

THE ONLY REVERSIBLE PUMP IN THE WORLD.



NEARLY **50** SUPPLIED TO THE GASLIGHT AND COKE COMPANY, LONDON.

PATENTEES AND SOLE MAKERS:
JOSEPH EVANS & SONS,
WOLVERHAMPTON.
ALSO THE "CORNISH" DIRECT-ACTING STEAM-PUMP.
THE "RAM" FLY-WHEEL PUMP.
HAND, HORSE, AND STEAM PUMPS FOR EVERY PURPOSE.

THE

MANN & WALKERS' PATENT SCRUBBER.

Extensive use. The successful and extensive use of the Mann and Walkers' Patent Scrubbers in all parts of the world has demonstrated their advantages, and entitled them to be received with credit and confidence. The number of them in use is about twenty times that of any other known means of purifying gas from ammonia.

Small quantity of Water required. By a very small quantity of clean water (not more than 5 or 6 gallons per ton of coals carbonized) the whole of the Ammonia contained in the Gas is completely absorbed; the Gas, after only once passing through, issuing from the Scrubber outlet completely purified from Ammonia. The Scrubber gives no appreciable back pressure.

Residual Product obtained. The Residual Product—namely, the Ammoniacal Liquor—is obtained at from 20 to 30 ounces commercial strength, which enables it, after being mixed with the weaker Liquor from the hydraulic main and condensers, to be sold to the Manufacturing Chemists, or converted into Sulphate, at the degree of strength found most profitable to the Gas Company.

Illuminating power increased. The Scrubber is a Saturator, and the Gas being soaked in this strong solution of Ammonia in the lower columns of the Scrubber, is purified from a large amount of Carbonic Acid, and its Illuminating Power is thereby increased.

Small amount of power required. The friction is so little, and the motion so slow, that the power necessary to work the Scrubber is almost inappreciable. A small gas-engine will work a pair of Scrubbers, purifying 2 million cubic feet of gas per day.

Beckton Gas-Works. There are thirty of these Patent Scrubbers in the Beckton Gas-Works, equal to purifying 30 million cubic feet per day, and the total amount of engine power necessary to work the whole 30 is not equal to that given out by one 10-horse engine.

Reserve purifying power contained. There is also a most important advantage arising from the height of these Scrubbers, in the reserve force contained in them. In the event of any stoppage, the mass of soaked and wetted material would continue the purification for hours, even if the supply of water and working were stopped from any cause.

Internal Materials not changed. The changing of the soaking materials in these Scrubbers is very seldom required; they are well known to remain in action for seven years without being emptied.

Guarantee. They are in all cases erected under guarantees; they easily fulfil the stipulations of any Act of Parliament, and the chemical restrictions of the Board of Trade; and in cost they are much less to a Gas Company than any other known means of purifying Gas from Ammonia.

C. & W. WALKER.

8, *Finsbury Circus, London, E.C.*

F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

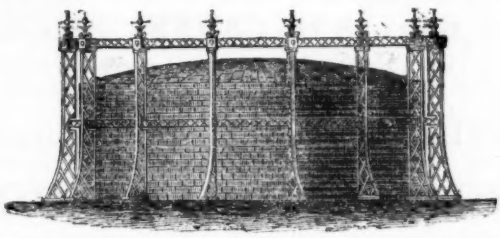
BROAD STREET, BIRMINGHAM.

ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS, WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.



THE HORSELEY COMPANY,

LIMITED,

TIPTON, STAFFORDSHIRE.

LONDON OFFICE:

6, WESTMINSTER CHAMBERS, VICTORIA STREET,

GAS ENGINEERS, IRONFOUNDERS, &c.,

MANUFACTURERS OF

GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED, LAMP-POSTS, PIPES,

AND ALL REQUISITES FOR EITHER

GAS OR WATER WORKS;

ALSO

MAKERS OF ROOFS, BRIDGES, &c.

S. OWENS & CO.,

WHITEFRIARS STREET, FLEET STREET, LONDON, E.C.,

Hydraulic Engineers,

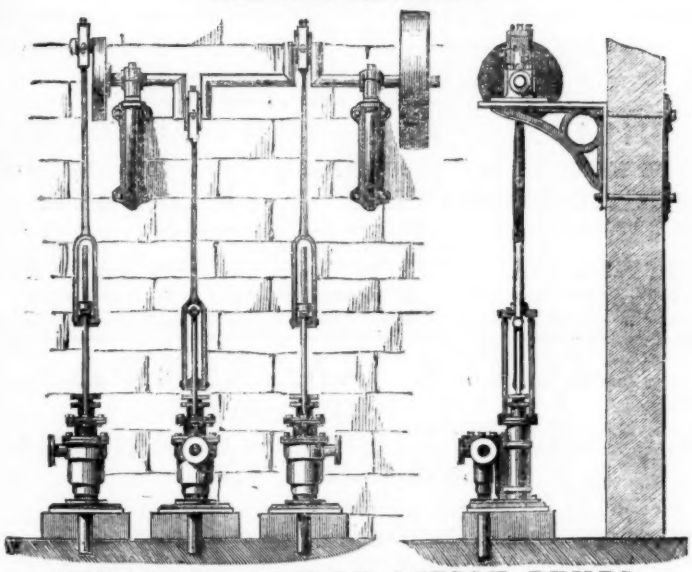
AND MANUFACTURERS OF

PUMPING MACHINERY of every Description.

SOLE LICENSEES AND MANUFACTURERS FOR GREAT BRITAIN OF

BLAKE'S PATENT DIRECT-ACTING STEAM-PUMPS.

MORE THAN 13,000 IN USE.



IMPROVED DOUBLE-ACTION PUMPS.

For Water. For Tar. For Ammoniacal Liquor.

This illustration shows an arrangement of three (No. 179) Improved Double-Action Pumps driven from the same crank-shaft, as frequently supplied for use in Gas and Chemical Works. The suction and discharge pipes can be arranged for drawing from and delivering in any required direction

These Pumps have been supplied to nearly all the large Gas Companies and Chemical Works, both for Pumping Water, Tar, and Ammoniacal Liquor.

GAS SYPHON PUMPS, IN COPPER OR SHEET IRON, ALWAYS IN STOCK.

Illustrated Catalogues sent post free on application.

T. NEWBIGGING,

CONSULTING GAS ENGINEER,

5, NORFOLK STREET, MANCHESTER.

HENRY LYON,

MECHANICAL AND CONSULTING GAS ENGINEER,

NORWOOD, NORTHENDEN ROAD,

SALE, NEAR MANCHESTER.

ALFRED LASS,

Fellow of the Institute of Chartered Accountants,

SPECIAL ACCOUNTANT FOR GAS AND WATER UNDERTAKINGS,

30, GRACECHURCH STREET, LONDON.

Accounts Analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.

The Forms of Account, which have been specially designed by Mr. Lass to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, Corporations, and Local Boards.

JOHN ROMANS, C.E., F.G.S.E.,

CONSULTING GAS ENGINEER

AND

CANNEL COAL FACTOR,

30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.

GAS-WORKS TAKEN ON LEASE.

MR. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

THOMAS PROUD,

BROOKFIELD WORKS,

103, ICKNIELD ST., BIRMINGHAM,

MANUFACTURER OF

WOOD GRIDS

FOR

PURIFIERS AND SCRUBBERS,

AND

GENERAL STEEL AND IRON TOOLS AND MATERIAL USED IN GAS-WORKS.

BOX'S PATENT STREET GAS-LAMP

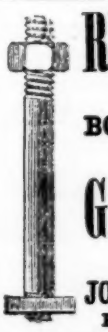
Has the following good qualities:—

1. No putty or other material is required for glazing. Thus there is no hacking out of old putty on removal of the glass, with the *consequent damage* to the lamp frames. 2. No liability to breakage by unequal expansion of the glass caused by changes of temperature. 3. Any inexperienced workman can glaze the lamp in a few minutes. 4. The system of glazing can be applied to any existing lamp at a trifling cost. 5. It is cheap, strong, and durable. 6. The glass can be easily removed so that the frames can be thoroughly painted inside and out.

The lamp may be supplied fitted with clear opal or ribbed glass, *as also with enamel tops* if required. The necessary fittings for altering existing lamps to this system can be supplied at moderate prices and a small charge for royalty. Licences granted on the most reasonable terms. For further particulars apply to the Patentee,

W. W. BOX,

Gas-Works, Crayford, Kent.



RETORT BOLTS,

AND ALL KINDS OF

BOLTS AND NUTS,

SUITABLE FOR

GAS-WORKS

SUPPLIED BY

JOHN S[illegible]

Bolt & Nu[illegible]

ALFRED ST., B[illegible]

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

198, ST. VINCENT STREET, GLASGOW.

TREES BOGHEAD.

SHOTTS BOGHEAD,

And all the first-class Scotch Cannels.

Prices and Analyses on application.

HEBBURN MAIN GAS COAL.

This Coal is now highly approved of for gas making, and yields over 10,000 feet per ton of 15-candle gas, and about 14 cwt. coke.

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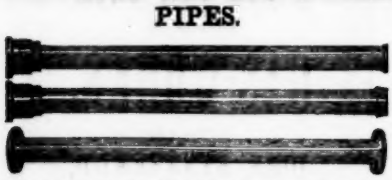

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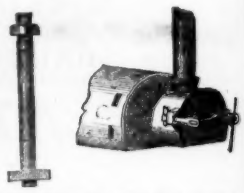

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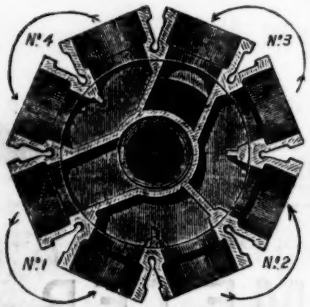

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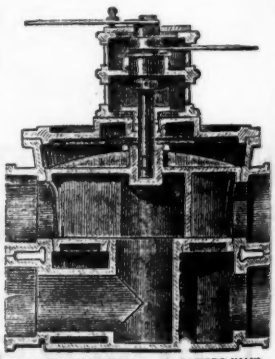

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